

**Climate Change  
Natural Resources**

Environmental Education

# **A BOOK OF ACTIVITIES**



Centre for Science and Environment

**Editor (Content & Direction)**

Sumita Dasgupta

**Copy & Research**

Ajanta Sikdar, Max Friedrich, Prachi Guron and Rama Srinivasan

**Cover and design**

Surya Sen and Karno Guhathakurta

**Illustrations**

Arundyuti Basu and Rustam Vania

**Photographs**

Sayantoni Palchoudhuri

**Layout**

Surender Singh

**Production**

Rakesh Shrivastava and Gundhar Das

**We are grateful for contributions from:**

Ashish Shah, Akshyeta Suryanarayan, Anubhuti Kapoor, Aryaman Anand,  
Bobby Chauhan, Khadija Mariam, Shanker Musafir, Rothin Datta,  
Sarthak Choudhary, Stefanie Sieloff, Sumedha and Vibhav Mithal

**We are grateful to our editorial advisors:**

Aditya Batra, Souparno Banerjee, Kaushik Das Gupta and Aditya Ghosh

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**Centre for Science and Environment**

41, Tughlakabad Institutional Area, New Delhi 110 062

**Ph:** 91-11-29956110 - 5124 - 6394 - 6399

**Fax:** 91-11-29955879 **E-mail:** [cse@cseindia.org](mailto:cse@cseindia.org)

**Website:** [www.cseindia.org](http://www.cseindia.org)

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Over the past 25 years or so, environment has appeared in different avatars in India's education arena. Sometimes as a handmaiden of mainstream subjects wedged between the pages of chemistry or history textbooks; in others as a common theme of all extra-curricular activities. From taking 'nature walks' in local parks to making scrap books on local fauna. But never, till now, was it a part of the formal grading system in schools.

Environment ceased to be a sideshow recently, after the country's apex curriculum setter and the two dominant education boards decided to allocate scores to the subject in the crucial school-leaving examinations. In a scenario where every single mark is viewed as a stepping stone to a future career, there could not have been a more significant move. Especially when it comes loaded with interesting conditions. As per the current guidelines, the assessment will not be based on the conventional 'study-text-books-write-examination' mode. Grades will depend on how active the examinee has been 'on the ground'.

Predictably, there has been a flurry of action ever since this diktat was passed. Treating environment as a living, breathing and 'doing' subject is not a task that teachers have been trained to perform. There are no ready resources available, no textbooks or reference books that fit easily in this mould. But as always, teachers have risen stoutly to the occasion and come up with remarkable ideas to turn environment into a tangible, grade-able entity.

This publication is an attempt to lend these teachers a helping hand. Featuring the friendly neighbourhood eco-guru Pandit Gobar Ganesh as the storyteller, this book unfolds in two sections:



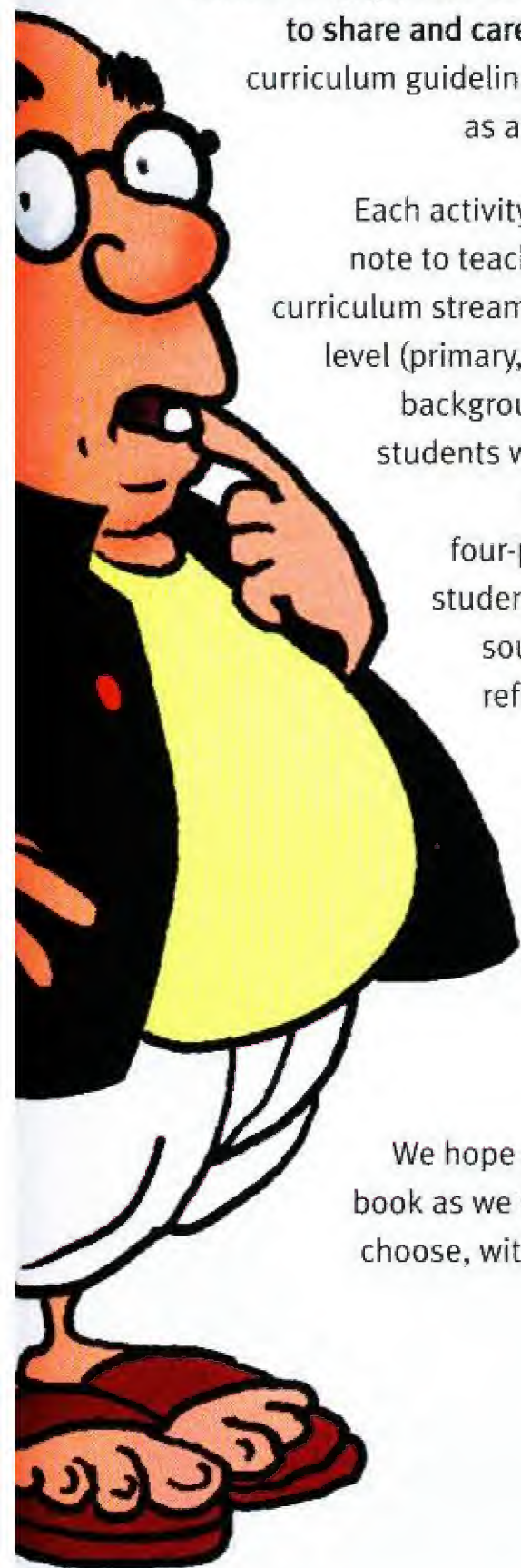
**Climate Change: How to make sense of it all** and **Natural Resources: How to share and care.** Here, the key issues selected adhere strictly to curriculum guidelines. However, they are introduced to students not as a paragraph to memorise, but as an activity to do.

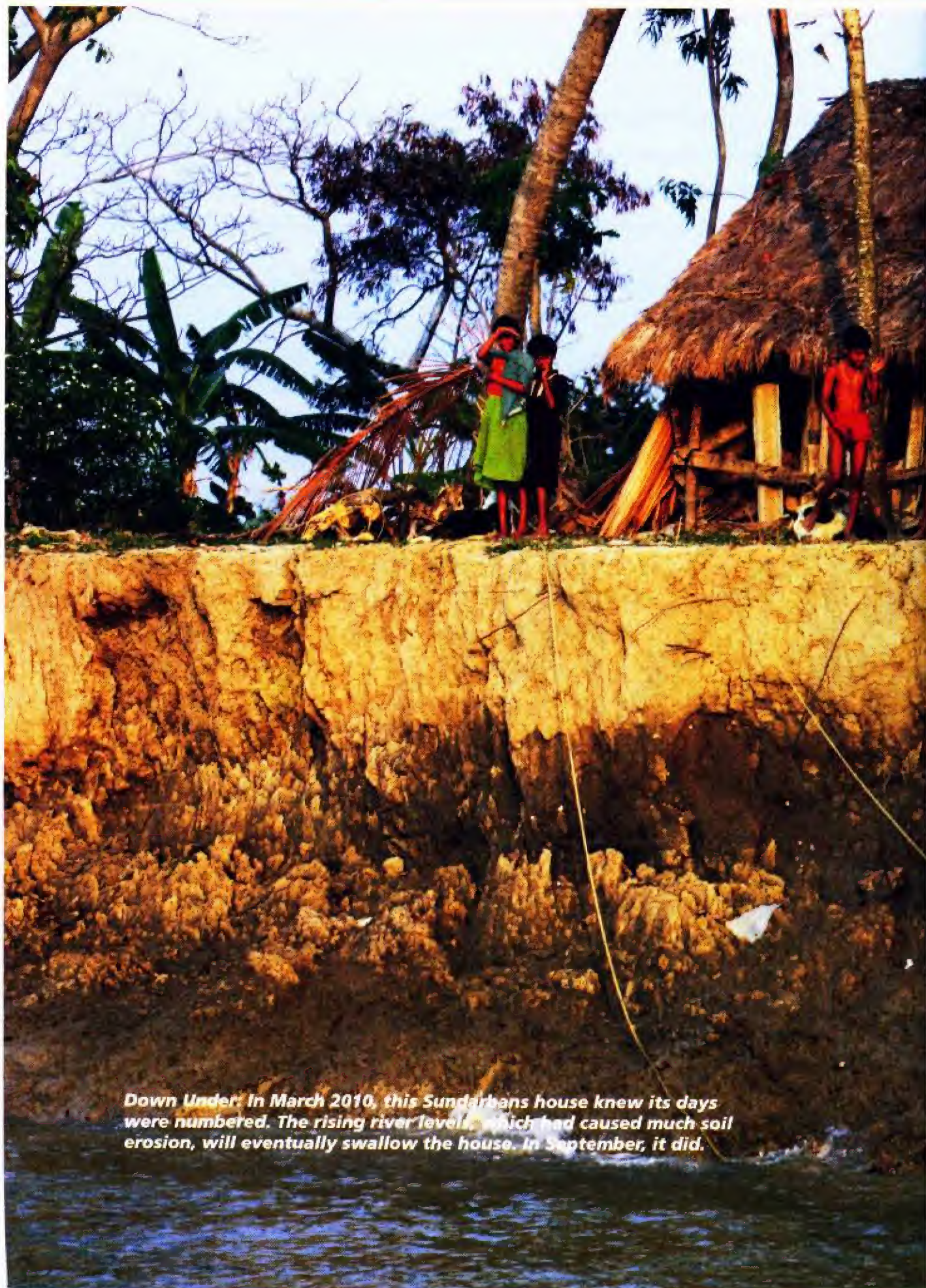
Each activity sheet begins with a **Curriculum Connect**, a brief note to teachers that matches suggested assignments to the curriculum stream (sciences, social sciences, etc.) and to the class level (primary, mid or senior). Likewise, **Gobar Gyan**, a succinct backgrounder that precedes each activity set, explains to students why they are being asked to do the task. We have made a determined effort to make each of these four-page activity sheets self contained; teachers and students should not have to hunt around for additional sources of information. Each activity sheet includes references to external information materials, online linkages and relevant data.

Readers will notice some overlap between the two sections. We meant that to happen, to press home the message that both are inherently intertwined. The causes and effects of Climate Change are imprinted on Natural Resources and the two cannot be separated.

We hope our readers will have as much fun acting out this book as we had putting it together. And that it will help them choose, with some clarity, the role they would like to play as future managers of this planet.

— Sumita Dasgupta





*Down Under: In March 2010, this Sundarbans house knew its days were numbered. The rising river levels, which had caused much soil erosion, will eventually swallow the house. In September, it did.*

A photograph of a coastal village. In the upper left, a thatched-roof hut sits on a cliff. Below it, a group of people, including children, are gathered on a green hillside. The cliff face is eroded, showing layers of earth and exposed tree roots. The bottom of the image shows the ocean with small waves. The title 'Climate Change' is overlaid in large white letters, with the subtitle 'How to make sense of it all' below it.

# Climate Change

How to make sense of it all

# Who wants to know about

**PANDITJI:** "Climate Change... AGAIN?!! Haven't we had enough?" Nope. These are not my words. I am just trying to mind-read you here... Ok folks, there is an overload of information on Climate Change now, and you already know all that you need to, right?

**SHAMIK:** You can say that again Panditji. The buzz on Climate Change (CC) is turning me deaf. I have crammed so much data that my brain is overflowing with it. Here, let me show you. (Starts counting on his fingers dramatically) I know Climate Change is a super critical issue. That the heat generated by the greenhouse gases (GHGs) is melting glaciers in the Arctic. So huge volumes of water are pouring into ocean beds, raising their levels dangerously and making them spill over and eat up large portions of coastal lands. I also know that CC has already started triggering dramatic changes in weather patterns. It will become even worse in the future. Rainfall will be more erratic and unpredictable. Storms and hurricanes will become more frequent. So will heat waves and droughts. Threats of natural hazards, ranging from cloudbursts, avalanches, landslides, to glacial lake outburst floods (GLOFs), mudflows and earthquakes will intensify...

**PANDITJI:** (laughs out loudly) Alright. I am convinced. Don't run out of breath.

**GODHULI:** But Panditji, there is stuff I still don't understand. Like why are we being bombarded with CC data missiles from every direction, every day? Do we really have to be experts on Climate Change? What difference will it make in our everyday life?

**PANDITJI:** Ahhh... Glaciers are too far away to lose sleep over, and natural disasters might happen anyway, right? Now let me ask you something else. What if there is news of malaria epidemics breaking out every year in India, instead of every five to seven years (as per the current pattern)? What if they turn more virulent than ever and invade areas that have never reported incidence of the disease before? Would you want to know more then?

**SHAMIK:** Come on, Panditji. You cannot directly link malaria breakouts with Climate Change!

**PANDITJI:** Yes I can. The National Physical Laboratory, New Delhi, has done a study on predicted impacts of Climate Change on human health, with a particular focus on malaria. The findings leave no room for doubts at all. The increase in temperature, humidity and the inconsistent rainfall pattern — all impacts of the changing climate — will nurture malarial mosquitoes. They will survive longer; breed more profusely; and spread in regions where they were

not found earlier. Would that not be a great disaster?

**GODHULI:** (waving her hands in agitation) Perhaps even greater than we can imagine, Panditji. India's health records are quite dismal. With almost half of our children below three years and one-third of the womenfolk falling in the 'underweight' or 'malnourished' category, we are just not strong enough to fight this battle!

**PANDITJI:** The bad news is

that this malnourished category is likely to swell enormously in the future. Yes, temperature rise will affect agriculture too. Especially in countries like India where agriculture is largely rain-fed, hence heavily dependant on the monsoons. Experts say the production of key crops like wheat, soybean, mustard, groundnut and potato will drop with every mounting centigrade. Yield of various kinds of fruits and vegetable will plummet. And of course, with less and less food to go around, more and more



# Climate Change?

people would join the under-fed camp. It's simple math, really.

**SHAMIK:** My god Panditji... I am frightened to even think about it. Do you really believe this is going to happen?

**PANDITJI:** (looking grave and unhappy): I wish I could say its all a stupid joke. I really do. But I am afraid its not. Its already happening, Shamik. Ask the apple growers in Himachal Pradesh. So many of them have been forced to move

to higher altitudes, just to ensure that their crop gets the chill that it requires to bloom. The orchards are getting too warm for the apples...

**GODHULI:** It all adds up, Shamik. We should have figured out the consequences even before Panditji told us about them. Along with the heat, frequent droughts and floods are bound to disrupt the harvest, too. (Looking up anxiously). I just thought of something else. If the changing climate is

going to breed mosquitoes, it would affect insects, pests, microbes and pathogens too, won't it? And these play a very crucial role in productivity. How will the farmers cope?

**PANDITJI:** I am glad you have asked me this Godhuli. It will be a severe blow for the farmers. With productivity slumping their livelihood will be at risk. And they are not the only ones. Other communities, too, are in serious danger of losing their income. Like the fisherfolk, the cattle rearers...

**SHAMIK:** Now my head is reeling. How are they concerned?

**PANDITJI:** Do you know that seven species of fish, including sand lobsters, have disappeared from the shores of Maharashtra during the past five years? Hilsa population has dropped dramatically in the Ganga tributaries. Fishermen have to take their boats to deeper seas in search of the Indian Mackarel, because it has retreated further from the coasts. Rise in ocean temperature is the cause of all this underwater upheaval. And the victims are the fishing community.

**GODHULI:** The animals are feeling the heat too?

**PANDITJI:** Studies show that the shooting mercury level has taken a toll on the health and reproductive systems of cattle and livestock. So now can you

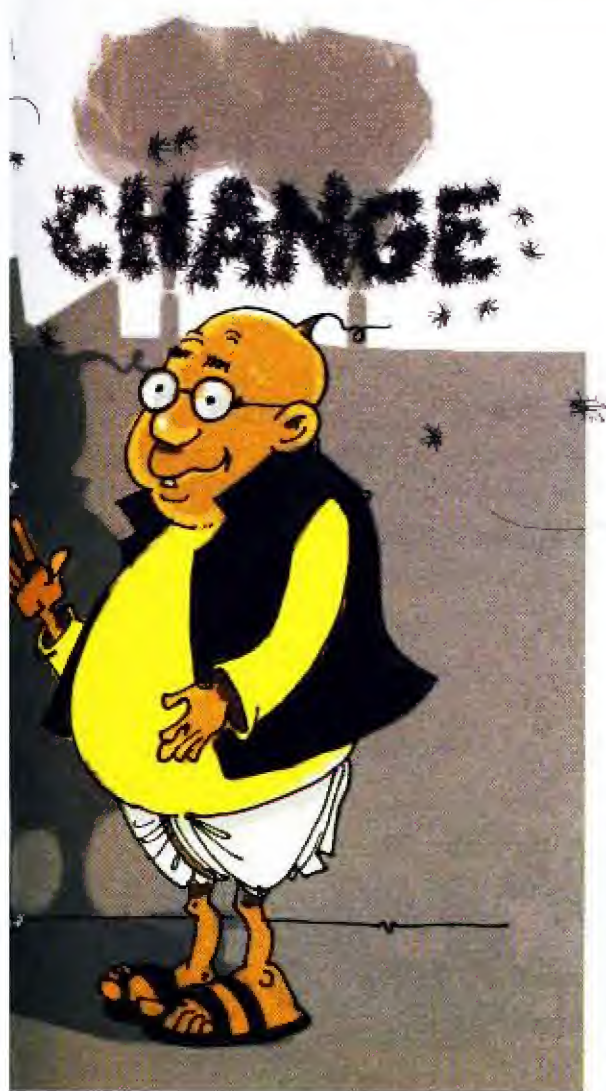
see how many communities and their economies have been hurt by this phenomenon called Climate Change?

**SHAMIK:** In fact, it is hurting each one of us! If food production is affected, and industries like fisheries, dairy, meat suffer a setback, how can the country's economy remain stable?

**PANDITJI:** (patting Shamik on the back) You know all of you are really smart. Of course India's economy is facing a serious threat! In fact, the global trade arena is on the verge of an upheaval, as countries which were till now exporters of food grains are being forced to turn into importers.

**GODHULI:** Panditji, we were so sure that we were experts on Climate Change that we were actually resisting more information being handed out to us! Now I feel I know so little. Please help us out here...

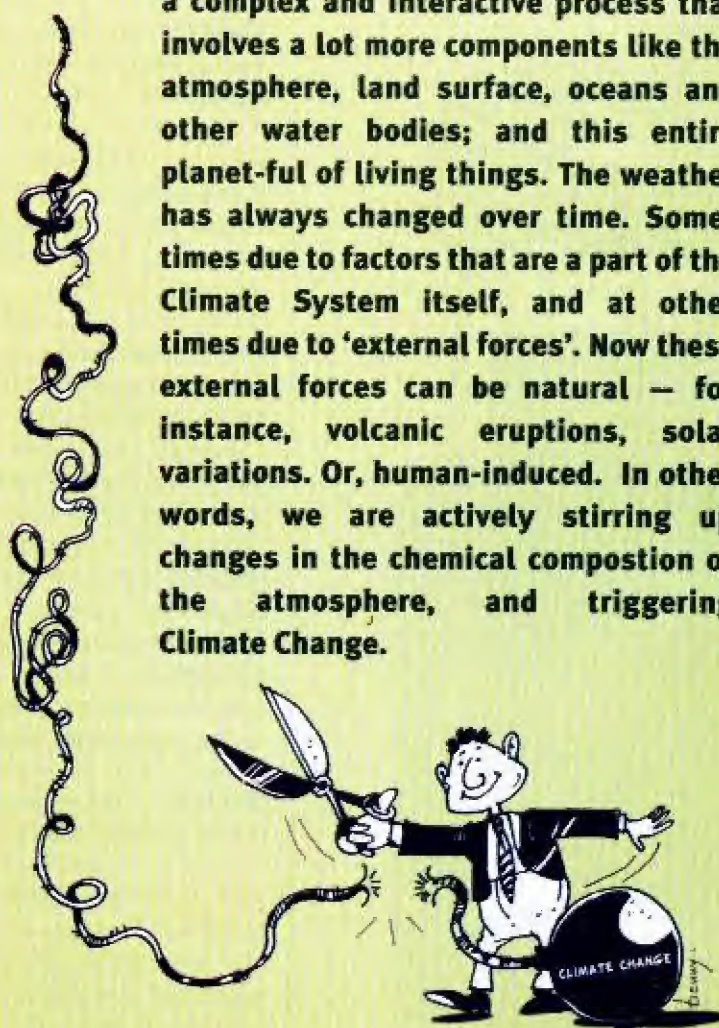
**PANDITJI:** Of course I will. Because you, the future citizens of Planet Earth, will have to face its impact. You need to learn to build cities, roads and villages in such a way that they are able to weather natural catastrophes of monstrous proportions. You have to protect human beings, animals, and all other living organisms against the onslaught. You have to master the art of Climate proofing. In the next few pages I will tell you how to take the first step. Then the reins are in your hands, folks!



# 1

## Rising Temperatures

The Earth's Climate System is not about changing weather or seasons alone. It's a complex and interactive process that involves a lot more components like the atmosphere, land surface, oceans and other water bodies; and this entire planet-ful of living things. The weather has always changed over time. Sometimes due to factors that are a part of the Climate System itself, and at other times due to 'external forces'. Now these external forces can be natural – for instance, volcanic eruptions, solar variations. Or, human-induced. In other words, we are actively stirring up changes in the chemical composition of the atmosphere, and triggering Climate Change.



Gobar Gyan

# Green Schools Network

## ACTIVITY SHEET

### Why talk about Rising temperatures?



The world is getting warmer and how. The scientists have proved this fact and we are living witnesses of it. During the last century, the earth warmed at an average of  $0.8^{\circ}\text{C}$ . That has never occurred in earth's history before. Prognoses predict that this global warming could result in a rise in temperature of more than  $6^{\circ}\text{C}$  until 2100. The consequences of such drastic Climate Change would be devastating.

But why is global warming happening? What have been the consequences so far? What is the greenhouse effect? What was the climate like in the past? Let's try to understand the earth's climate a little better and find answers to these questions in this Activity Sheet.

Name .....

Class ..... Date .....

**Curriculum Connect:** These activities can be used by the higher secondary students to develop a deeper understanding of environmental phenomena and their ramification at all levels – social and economical. Students can take up these activities for their project work on studying village/local profile of their residential area for political science, geography and science subjects.

### Gobar Gyan

#### Fossil fuels and global warming

We all agree that Climate Change is a burning issue in world politics and needs immediate attention. The use of fossil fuels is the single most important cause of global warming. So what is the solution for global warming? Substituting fossil fuels with energy from renewable sources is the most logical answer to the problem. Renewable energy, simply put, is energy drawn from an inexhaustible source such as sunlight, wind, flowing water or biological growth based fuels such as bio-diesel. Micro hydro power, a widely used form of renewable energy, has flowing water as its source of energy and produces no carbon dioxide ( $\text{CO}_2$ ), a major greenhouse gas.

#### Why is the Earth a greenhouse?

The atmosphere, a gaseous layer, surrounds the Earth. Sunlight enters the atmosphere and warms the land and water which radiate this energy back in the form of heat radiation. However, some gases, called 'greenhouse gases', don't let the heat radiation go through. Like the panes of a greenhouse, they reflect it back to the ground and hence, trap the heat.

Essentially, this is a natural process. However, humans have been significantly increasing the amount of greenhouse gases in the atmosphere, mostly by burning fossil fuels and forests. This is why more and more heat is trapped and the earth is becoming warmer.

### Activity — 1

#### Global warming: Local level

Has your area become warmer during the last 50 years? Find out by conducting interviews with elder people of your community. If you live in a rural area, make sure you ask the farmers as they know the most about weather. Here, some questions you could ask.

Name: ..... Profession: ..... Age: .....

When was the hottest summer?

When was the coldest winter?

If you compare the temperatures between when you were young and today, can you observe any changes? If yes, what are those changes?

Have you observed any other weather changes?

If there are any changes, how have they affected your and your family's life?

If there are changes, how have they affected the nature of your area?

Conduct this interview with four people. Write a report on how the weather has changed in your area/region.

## Activity — 2

### Build your own greenhouse

To understand how a greenhouse works, it is best to build one yourself. For this, you will need:

- 4 metres of metal wire (The wire should be bendable but stiff enough to keep its shape when bended. You can use telephone wire.)
- 2 square metres of transparent plastic foil
- 1 roll of transparent tape
- 1 box, sized around 10 cubic centimetres, preferably cube-shaped
- 5 pages of white paper
- Glue
- A watch
- 10 ice cubes of the same shape and size

### Get started

- a. First, construct the skeleton of your greenhouse. Bend the wire in the form of a cube. Each side should be 30 cm long (approximately).
- b. Paste one side of the cube-shaped box with white paper. Next, wrap the box with plastic foil.
- c. Take another sheet of paper and fold it as shown in the picture below. Each side should be 8 cm long.

### See how greenhouse gases work

1. The first experiment showcases a world without greenhouse gases where all the heat radiation escapes into space.

Put up the skeleton of your greenhouse in a sunny but windless place. Put the box in the middle of it with the white side up and an ice cube on it. Shade the ice cube with the folded paper. Track the melting time and repeat the experiment two more times. Note your data here.

Day 1 =	Day 2 =	Day 3 =	Average =
---------	---------	---------	-----------

2. The second experiment showcases a world with the natural greenhouse effect. Here, greenhouse gases radiate back some of the Earth's heat while some heat escapes into space. There are still 'holes' in the greenhouse layer.

Wrap one layer of foil around five sides of the wire cube. Punch small holes into the foil. Put the ice cube as in the previous experiment and measure the melting time.

Day 1 =	Day 2 =	Day 3 =	Average =
---------	---------	---------	-----------

3. The third experiment shows the enhanced greenhouse effect, caused by human intervention. Here, there are no more 'holes' and a bigger share of the sun's heat is trapped.  
Wrap more layers of foil around the existing layer and repeat experiment 2.

Day 1 =	Day 2 =	Day 3 =	Average =
---------	---------	---------	-----------

Now, compare your data. Shorter melting time indicates higher temperatures. In which experiment is the temperature highest? Explain why.

### Is the entire world really getting warmer?

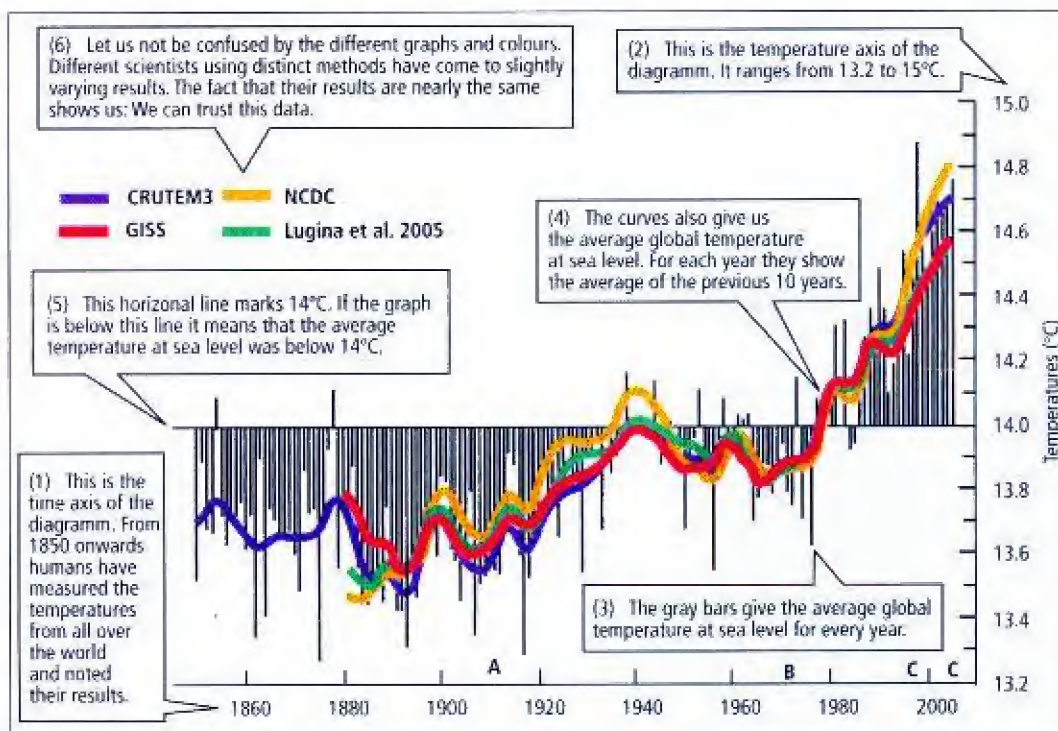
Yes, it is. The chart (right) contains important data about Climate Change. It shows how the average temperature has changed over the past 150 years. The callouts will give you all the information you need to understand it!

### Activity — 3

#### Feeling hot? Here's why.

Points A, B and C are on the time axis. Write about climate at any given point.

- A (Example): This point marks 1910. This year, the global average temperature at sea level was 13.6° C. The average temperature at sea level of the previous decade was 13.55° C.



Source: Group 1, Fourth Assessment Report, 2007, Intergovernmental Panel on Climate Change

The period around 1910 marks the beginning of an almost constant temperature rise that continued until the 1940s.

B: \_\_\_\_\_

C: \_\_\_\_\_

Now, answer the following questions:

What time span is covered by the graph? \_\_\_\_\_

When was the hottest decade? \_\_\_\_\_

When was the coldest decade? \_\_\_\_\_

By how many degrees has the temperature increased between those periods? \_\_\_\_\_

What is the key information you have learnt from the graph? \_\_\_\_\_

### Activity — 4

## Climate in the past

What makes the current Climate Change so dangerous is its speed. Never before in Earth's history has the climate changed as fast as it is changing now. Slow changes, you must know, have always occurred. Our planet has experienced periods of vast ice covers and glaciers as well as almost ubiquitous tropical heat. In this Activity, you will see how parts of the world looked like in the past. At what time? Do the crossword and see what letters come in the yellow fields. The letters match those printed in the pictures and will tell you when the world looked as on the pictures.

1											8,000 years ago
					2						150,000,000 years ago
			3								20,000 years ago

- 1: Arid grassland spotted with small trees but without a closed tree cover (solution: Savannah)
- 2: Group of present animals which are the closest relatives of the dinosaurs (solution: Birds)
- 3: Elephant like mammal which lived during the ice ages in Tundra (solution: Mammoth)



\_\_\_\_\_ years ago.

The polar regions of the world were covered by ice shields. In the northern hemisphere, these ice shields extended to most of Northern Europe and vast parts of North America. This image shows how Spain looked like at that time.



\_\_\_\_\_ years ago.

This picture shows how the Sahara desert might have looked like at this time. It was covered by vegetation and even trees. A fertile Savannah inhabited by elephants, giraffes and also humans was at the place where the biggest desert of the world is at present.



\_\_\_\_\_ years ago.

Dinosaurs dominated vast parts of the earth. The temperatures were higher than today and the air more humid. Lush jungles covered most parts of the land area.

## Gobar Gyan

## What glaciers tell us about climate in the past

Did you know that there are small bubbles of air trapped in glaciers? This air is approximately as old as the surrounding ice. In analysing the composition of the air, scientists can determine the greenhouse gas concentrations at that time and also the temperature. But how do we know how old the air bubbles and the surrounding ice are?

When snow falls in Antarctica and Greenland, most of it does not melt and accumulates for many years. The lower layers get compressed to ice and form glaciers. Imagine it as a cake with multiple layers!

Drilling carefully through glaciers, scientist can extract ice cores — rods of ice. On counting the number of layers from the top, they know exactly when the ice was formed. The origin is analysed with air bubbles.

# 2

## Greenhouse Gases

In the atmosphere, carbon usually pairs up with two oxygen atoms and takes the form of carbon dioxide (CO<sub>2</sub>). The heat trapping properties of CO<sub>2</sub> helps keep the Earth from freezing, by creating the greenhouse effect. In this, carbon, with a host of gases like methane, sulphate, chloride and nitrates, heat up the planet like a garden greenhouse.

The problem is that there has been a rapid increase of CO<sub>2</sub> in the atmosphere over the past 250 years. So, Planet Earth's temperatures remained nearly stable for about 1,000 years, and then there was a sharp increase since 1800s. The main culprits are the fossil fuels like coal, oil and gas—the fumes of which contain CO<sub>2</sub> gas. Nature had, of course, provided an in-built solution to this problem. The Earth's ecological sinks — its forests, oceans, soil and vegetation — have the capacity to absorb the harmful gases. Global warming is caused only when greenhouse gas emissions exceed the cleansing capacity of these sinks. Obviously, the world has now crossed this limit. Many times over.





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Greenhouse gas emissions?



The world is warming because of increasing greenhouse gas concentrations in its atmosphere. Like a transparent blanket, greenhouse gases prevent the earth from radiating the sun's energy back into space. Consequently, the world has already warmed up by approximately  $0.8^{\circ}\text{C}$  and could heat up by as much as  $6^{\circ}\text{C}$ .

Let's have a closer look at these greenhouse gases. What are they? When do you emit greenhouse gases? How are they removed from the atmosphere? And how can you lessen emissions and save the climate?

Name .....

Class .....

Date .....

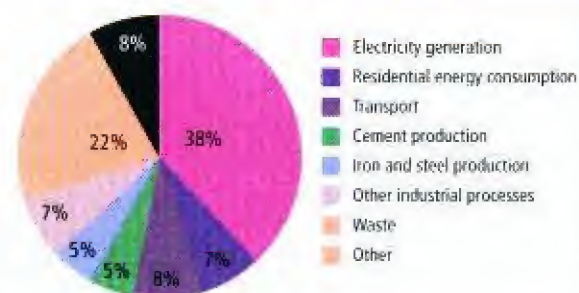
**Curriculum Connect:** These activities can be used by the higher secondary students to develop a deeper understanding of the greenhouse phenomena and emissions. Students can take up these activities for their project work by auditing the greenhouse gases responsible for global warming in their residential area under science and geography.

### Gobar Gyan

#### How much greenhouse gases does India emit?

In 2007, the total emission of greenhouse gases in India was 1,727 billion tonnes of  $\text{CO}_2$  equivalents. See the chart (right) to find out which sources they originate from. The chart includes all greenhouse gases and the percentages show how much the emissions of each source contribute to global warming.

Greenhouse Gas Emissions in India 2007



Source: Agarwal, Anil and Narain, Sunita 1998, 'Boiling Point', *Green Politics: Global Environmental Negotiations*, Centre for Science and Environment, New Delhi, p21

### Activity — 1

#### When do you produce greenhouse gases?

1. When you use electricity. Most of India's electricity is produced from fossil fuels such as coal. Burning of coal produces large amounts of **Carbon dioxide ( $\text{CO}_2$ )**, a major greenhouse gas.

When do you use electricity? Name ten activities here:

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$\text{CO}_2$  accounts for more than 70 percent of global warming. It is also emitted during the burning of petrol, the fuel of our vehicles.

Which vehicles does your family own?

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Accounting for 17 percent of global warming, **Methane ( $\text{CH}_4$ )** is another crucial greenhouse gas. It is produced during the degradation of waste in landfills, burning of forests and rice paddies. Another big Methane source are the stomachs of ruminants. Can you name five domestic animal species which produce Methane?

Another greenhouse gas, **Nitrous Oxide (N<sub>2</sub>O)** globally contributes 10 percent to Climate Change. It is mainly produced through an intensive use of fertilisers. In India, N<sub>2</sub>O emissions are very low.

There are other greenhouse gases too. But the quantities in which they are emitted are so small that their contribution to global warming is not significant.

Do any of your daily activities release greenhouse gases? Compile a list and compare it in your class.

Don't despair if you just realised how you release greenhouse gases on a daily basis. Here, we tell you ways to reduce your emissions in the next activity. You can do a lot!

## Activity — 2

### Reduce your CO<sub>2</sub> emissions: Here's how

Yes, you can help fight Climate Change!

#### 1. Plant a tree

Trees are real climate savers. Why? Well, because they remove CO<sub>2</sub> from the atmosphere. They also give us shade and fruits, right? You could have your own kitchen garden and save money while contributing to the environment. Start today. Plant a tree!

See which place in your neighbourhood would be suitable to plant a tree and where could you cultivate fruits or vegetables. Who might want to help you? Who could you ask for advice?

#### 2. Save power

Whether an AC or a light bulb. All appliances that consume electricity send greenhouse gases into the air. You can really save the environment by minimising your electricity consumption. For example, **turn off** the lights and TV **when you leave the room**. Did you know that our body works best at an outside temperature of around 25 ° C? So, there is really no need to run a power guzzling **AC** to cool your house beyond this temperature. Also, many appliances like TV consume electricity when they are switched off but still on **stand by mode**. A plugged mobile charger consumes electricity even if the mobile is not connected. To get rid of these energy vampires, switch off the electrical sockets themselves. If there are no switches, get a **multiple socket with a switch**. Simple, isn't it?

Note all the electrical appliances in your house. For each appliance, note as many ways to reduce its energy consumption as possible. Be creative.

### 3. Go green

Motorcycles, cars and buses all emit greenhouse gases in varying amounts. Did you know the more the number of people in the same vehicle, the less is the amount of CO<sub>2</sub> emitted per passenger? This means that a bus is better for the climate than a car. Please note that this thumb rule is not valid for aircrafts which are real climate killers. Unmotorised transport does not emit any CO<sub>2</sub>, right? So walking, cycling and even bullock carts are very climate friendly modes of transport.

Which mode of transport do you use in your daily life? List them here. Can you shift to more climate friendly modes of transport?

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### 4. Buy smart

All products we buy, have, use or throw have been produced and transported. A lot of energy is consumed for this, resulting in the release of greenhouse gases. Now, here's how you can reduce these hidden CO<sub>2</sub> emissions. 1. Buy only what you really need. 2. Buy good quality and durable products that last long. 3. Reuse or recycle. Sell recyclable waste to the *kabadiwallah*. Don't use products like disposable cups or poly bags. This will also reduce your trash pile.

What ideas do you have to reduce your hidden CO<sub>2</sub> emissions?

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### 5. Spread the knowledge

The more you know about Climate Change, the more you can contribute to save the climate. This book will give you a lot of information but don't leave it at that. Read more about topics that interest you and share your knowledge with others. Try to motivate others to protect the climate.

Note what you wish to know more about. Also, might be interested to learn more from you about Climate Change.

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### 6. Get a green job

If you really want to make a difference, you can choose a profession that let's you do just that! You could be a journalist who informs the public what they can do, an engineer trying to find out how to make solar power cheaper, a psychologist who explores how to motivate people to save energy, a scientist who tries to understand the climate better or a teacher who tells his/her students about global warming. There are thousands of green jobs!

Do you already know what you want to become? See if you can link it to saving the climate.

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## Gobar Gyan

### How is CO<sub>2</sub> removed from the atmosphere?

Have you ever wondered where all the material that forms the wood of a tree or the leaves of a plant comes from? It cannot come from the soil alone. Plant a sapling and see it grow. The sapling will grow and the soil will remain intact, right? Well, this goes to show that the substance which forms a tree's wood and a flower's leaves comes from the atmosphere. You guessed it: CO<sub>2</sub> is consumed by plants through their leaves and converted within their organism.

### CO<sub>2</sub> Chain

Plants take up CO<sub>2</sub> from the atmosphere to grow and release it back when they decay. The CO<sub>2</sub> is retained when the decay doesn't occur for some time. This helps the climate. How? If CO<sub>2</sub> is in a tree and not in the atmosphere, it cannot act as a greenhouse gas and contribute to global warming! Ecosystems that remove CO<sub>2</sub> from the atmosphere for a long time are called CO<sub>2</sub> sinks.

### Activity — 3

#### What is Photosynthesis?

The process in which  $\text{CO}_2$  gets converted into biomass such as wood or leaves is called photosynthesis. Can you explain how photosynthesis works? Feel free to write or draw.

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Do you know photosynthesis takes place in which organisms? Think of terrestrial as well as aquatic organisms.

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### Activity — 4

#### Neighbourhood sinks

Draw a map of an area in your neighbourhood (sized one square kilometre). Mark major houses and roads. Next, go around and visit different types of sinks like trees, forests, seashores, wetlands, or any green area that you find. Estimate how long it takes for the biomass in it to decay to find out which sink is the most efficient. For example, in wetlands, biomass does not decay or if at all, it decays very slowly. This is what makes them highly effective sinks.

### Gobar Gyan

#### Oceans: Enormous $\text{CO}_2$ sinks

Observe a glass of soda or cold drink. Can you see the gas bubbles that make the liquid sparkle? These bubbles are made of  $\text{CO}_2$  that escape when you start drinking!

Oceans do exactly the opposite. They consume almost one-third of the  $\text{CO}_2$  that humans release in the atmosphere. First,  $\text{CO}_2$  gets dissolved in water. Then, parts of it are consumed by algae and other organisms through photosynthesis. When these organisms finally sink to the bottom of the ocean, the carbon contained in their bodies is trapped there for thousands of years.

#### Oil and Gas: How are they formed

Have you ever wondered how fossil fuels like oil, gas and coal are formed?

The formation of oil and gas takes place over a period of million of years. They are essentially remains of oceanic organisms that sink to the sea floor and are buried by sediments. Over time, there is an increase in the temprature, pressure and quantity of loaded sediments.

**By the way:** The origin of coal is very similar. Do you have any idea how coal is formed?

# 3

## Global Warming

So we know for sure that the Earth is warming up and at an uncomfortably rapid pace. Will we feel the heat? Unfortunately, yes. The most critical link between glaciers and climate is maintaining the earth's water balance. In fact, it is already happening. Alaska's melting glaciers, sea ice, and a type of frozen soil called permafrost, are adding an extra 0.3 millimetre a year to the depth of oceans. Between the 1950s and 1990s, Alaskan glaciers contributed only half that much water. The flow in the rivers that are fed by glaciers is also erratic now. They swell to dangerous heights in the rainy season and then get uncharacteristically dry during the rest of the year. And, of course, there have been dramatic changes in rainfall patterns. In a country as dependant on monsoons and rivers for survival as India, such trends are ominous.



Gobartimes

## Green Schools Network

## ACTIVITY SHEET

## Why talk about Impacts of global warming?



Global warming will change India. First, it will change India's primary fresh water source: the monsoon. Second, it will lead to rising sea levels turning millions of people homeless.

If Climate Change continues unabatedly more than 120 million people in South Asia would become climate refugees. This equals to more than 10 times the number of people displaced during the partition. Approximately half of the South Asian climate refugees would be in India.

Let's understand a little better how global warming will change our country. How do we depend on the monsoon and how will the monsoon change? What can we do to prevent floods? Why will sea levels rise and how will this affect the country? Find out in this Activity Sheet!

Name .....

Class ..... Date .....

**Curriculum Connect:** These activities can be used by the higher secondary students to comprehend handon the greenhouse effect. Students can expand these activities for their project work under science, geography and political science subjects.

### Gobar Gyan

#### The lurking water crisis

On the one hand, there will be too much water resulting in floods. On the other, freshwater will become an even more precious resource during most parts of the year. Since the number of rainy days will decrease, less rainwater will be able to infiltrate the soil. But it is exactly this infiltrating water which would recharge the groundwater and could then be extracted by humans in times of water scarcity.



In the long term, another (so far) reliable freshwater resource will decrease. The melt water of glaciers supply our rivers, especially during the dry season. Now, glaciers are disappearing and in the coming times, rivers will have even less water during summers.

#### Rising sea levels

Did you know that 60 million people in India live in coastal areas that lie less than 10 metres above the average sea level? This also includes vast parts of the metros (Mumbai, Kolkata and Chennai). If greenhouse gas emissions increase unabatedly and the earth warms by five degrees or higher, the sea level is likely to rise by one to five metres. The people living in low elevation areas will be rendered homeless and migrate mostly to other major cities within the country which will themselves have difficulties coping with climate change. In Bangladesh another 60 million people live in areas below 10 metres above sea level. Rendered homeless they will surge towards India.

#### Reasons for rising sea levels

First, if the atmosphere warms up the sea water also becomes warmer. In consequence, the water expands and occupies more space. Second, a warmer air temperature melts glaciers and the ice caps at the poles. The melt water adds to the oceans. During the last 100 years, these processes have caused sea levels to rise by one to two millimetres per year. If humans continue to blow more and more greenhouse gases into the air, sea levels will rise between one and five metres.

#### Warmer world: Heavier rains

In Activity 1, you have seen how much we depend on the monsoon. The alarming truth is that we cannot rely on it in the future in the way we could in the past. Global warming will change the rain patterns in India. Probably, there will be more extreme rains. This means that huge amounts of water will fall in only few days and lead to more floods.

## Your Activity

### Activity — 1

#### Be a climate scientist!

Be a climate scientist and check if the projections we have made on this sheet are reasonable. For this, have a closer look at the past 60 years. We know that the world has warmed up by more than  $0.6^{\circ}\text{C}$  during that period. Let's now find out if the number of floods and droughts inflicting parts of India has increased during the same period.

First, fill the second column of the table below with the floods and droughts you can identify. Ask family members and the elders of your community or research online to obtain information. Next, sum up the total number of events and number of people afflicted for each decade. Have these numbers increased during the last 60 years? If they actually have, we have found a strong correlation between global warming and changing monsoon patterns. Most probably this correlation will be valid for the future too.

Decade	Event, people affected	Number of events	Total number of people affected
1951 – 1960			
1961 – 1970			
1971 – 1980			
1981 – 1990			
1990 – 1999			
2001 – 2010			

### Activity — 2

#### Flood Adaptation: How to cope with the future?

Global warming will increase the risk of floods in India. This makes efficient flood management indispensable. But which measures actually make sense? Find out what is good about the measures given below and what disadvantages they involve. Also, find out more measures which are implemented today. Then discuss in class: What is your master plan for flood management in India?

Dams	Embankments	Afforestation
Advantages	Advantages	Advantages
Disadvantages	Disadvantages	Disadvantages

Share your ideas with your school. Write an Article in the School Bulletin or prepare a wall chart. If you feel confident you might also address your school's science teachers offering to come to their classes and make a presentation about flood management

### Activity — 3

#### Melting ice cubes: What happens in the oceans

You can observe for yourself how warmer temperature leads to higher sea levels. Take a transparent bottle and cut the upper part in the shape of a glass. Now, fill it until two centimetres under the brim and put five ice cubes inside. Mark the water table with a waterproof pen on the bottle and cover the bottle with plastic foil. Now, put the bottle in a warm but shaded place and wait until the ice cubes have melted. What is the melting time? Wait another five minutes and check the water level. How much has the water table risen? Explain how the experiments reflect what actually happens with the oceans. What real processes does the model cover properly? What are the weaknesses of our model?

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### Activity — 4

#### Neighbourhood impacts

Conduct an interview to get to know how your neighbourhood is affected by Climate Change. You already know that the climate has become warmer. But what about the impacts?

Name: \_\_\_\_\_ Profession: \_\_\_\_\_ Age: \_\_\_\_\_

- Has the monsoon changed in your neighbourhood during the last 30 years? If yes, how?

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- Is your region more affected by droughts and floods today than 30 years ago?

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- If you are in a coastal region, have there been more floods during the last 30 years?

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- If you are in a coastal region, are there houses or villages which had to be resettled because of floods?

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Write an assessment on the basis of your interviews and send it to us. We will collect your results and compile a report about the impacts of climate change based on your findings. The report will be published in our monthly magazine *Gobar Times*.

### Activity — 5

#### Climate or Weather?

The distinction between climate and weather is extremely important when we talk about Global Warming. To find out more about this difference, read the following conversation.

- A: The weather is really nice today!  
 B: Oh yes, it's cool and pleasant, it should be always like that.  
 A: Yeah maybe. But you know I actually like the climate here. Every season is special: summer, rain, winter.  
 B: Yeah but this winter was really cold. That doesn't really fit into the picture of climate change and a warming world, does it?  
 A: It actually does. This winter the weather was indeed very cold. During the last few years by contrast, there were not many really cold winters. You know, if we talk about climate we always consider a period of at least 10 years.  
 B: That makes sense. In general, it is getting warmer indeed.  
 A: And I have never heard anybody saying: "Oh the climate was really cold this winter." That sounds wrong.

Have you followed the conversation of A and B? Write here what the differences between weather and climate are.

Weather: \_\_\_\_\_

Climate: \_\_\_\_\_



## Equity and Negotiations

In order to contain the rise in global mean temperature within 2 degrees celcius, the world needs to keep CO<sub>2</sub> concentrations in the atmosphere in the range of 350-400 ppm, and the total concentration of GHGs to 450 to 500 ppm. Are we prepared to tackle this challenge? Have we, the global community, taken some steps already?

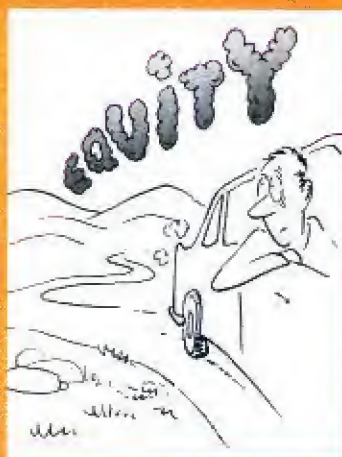
Nearly fifteen years ago, at the Earth Summit in Rio de Janeiro, the world's governments had signed a pledge to prevent 'dangerous climate change'. But the planet continues to sizzle. Why? Because the use of fossil fuels is, unfortunately, closely linked with economic growth and lifestyle. As a nation grows more prosperous, its consumption of fuel—for transport, power generation and various other so-called 'necessities' of life—zooms up, too. No wonder the ongoing International negotiations under the UN Framework Convention on Climate Change—have turned into a tug of war between the developed (read rich) and the developing nations (ranging from middle-class to poor).

# Green Schools Network

Gobar Times

## ACTIVITY SHEET

### Why talk about Equity and Climate Negotiations?



Why do people cook, drive cars, consume electricity, heat or cool their houses and do all these things that help to put greenhouse gases into the air? They do it because these actions help them to fulfil their basic needs or shape their life in a way they like. And doesn't every human have an equal right to fulfil his/her needs and live his/her life in the way he/she likes?

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be used by the higher secondary students to develop an understanding of the support system of national and international agencies that have been setup to combat climate crisis. Students can take up these activities for their project work under political science and sociology subjects.

### Gobar Gyan

#### Equal rights to pollute

If we agree that every human is equal, we also have to agree that every human being has the equal right to set greenhouse gases into the air. Every human has the same right to pollute.

On the global scale, this means that developing countries have the right to increase their greenhouse gas emissions in the cause of their industrial development. Rich countries have to cut their emissions drastically and give so much space in the atmosphere that developing countries can develop AND global warming is abated.

#### Who pollutes and who suffers?

But do all countries pollute equally? No. It is the rich in the world who use most of the world's energy and by that set greenhouse gases into the air.

Rich industrialised countries like US, EU, Japan or Canada account for roughly 45 percent of the world's CO<sub>2</sub> emissions but have only few of the world's population. At the same time, these countries are well prepared to cope with the impacts of climate change. Being highly developed, they do have the money and technologies to resettle flood prone population, manage increasingly unpredictable weather, and buy their food on the world market even if its prices go up due to losses of yields. Developing countries do not have these resources. India can simply not afford to resettle 60 million people and accommodate additional climate refugees from Bangladesh. India cannot afford significant losses in its agricultural production due to unstable monsoon rains.

Still to point only at others would not be fair. The rich in India pollute as much as the rich anywhere in the world. It is the poor who cannot afford technology and electricity who give the rest some space to breathe. And at the same time, it is the poor who are most vulnerable to the impacts of Climate Change.



## Activity — 1

### Per capita emissions

To compare the CO<sub>2</sub> emissions of countries, we have to compare the average emissions per citizen.

On the right, you see a chart which shows the per capita emissions of some countries. Can you complete it with the graph for India? In 2007, India had a population of 1.1 billion people. The country's total CO<sub>2</sub> emissions were 1.6 billion tonnes. Write the per capita emissions here \_\_\_\_\_ [t CO<sub>2</sub>/capita/year] and add the graph to the chart.

## Activity — 2

### Commuting to school and per capita CO<sub>2</sub> emission

Please note: This activity is not about blaming. There might be good reasons for some of you to travel to school by your personal vehicle. Buses could be unavailable, bicycles might be unsafe or you might be living far from school. Participation in this activity should be voluntary.

Fill the table with the required data. You will have to copy it to a separate sheet first. Apply the following formula to calculate the CO<sub>2</sub> emissions for each member of your class.

Distance \* Emission factor / Persons in the same vehicle = CO<sub>2</sub> Emissions

Total number of students	
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Student Number	Distance both ways [km]	Emission factor [g/km]	Number of persons going in the same vehicle	CO <sub>2</sub> emissions [g]

Sum	
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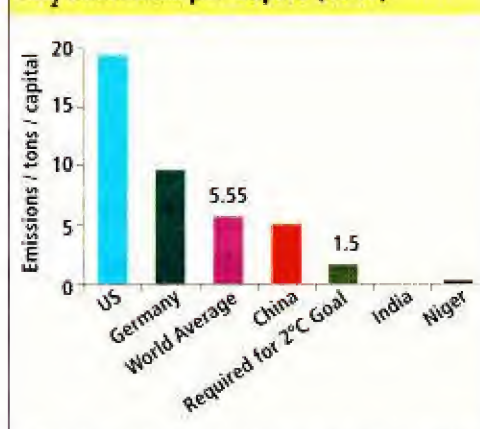
Apply the following emission factors:

Mode of transport	Emission factor [g/km]
By foot	0
By bicycle	0
By bus / minibus	215
By car	407
By three wheeler	78
By cycle	28

To calculate the per capita CO<sub>2</sub> emissions per day from commuting of your class, divide the sum total sum of CO<sub>2</sub> emitted by the number of students. Write your result here.

CO <sub>2</sub> emissions per capita per day while commuting		[gCO <sub>2</sub> /capita/day]
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CO<sub>2</sub> emissions per capita (2007)



Source: MDG Indicators website <http://unstats.un.org/unsd/mdg/SeriesDetail.aspx?srid=752> as viewed on 15th November 2010

You can now easily compare the CO<sub>2</sub> emissions of different classes in your school. You can also compare big and small classes with each other directly because the per capita value is per individual. In the same way the CO<sub>2</sub> emissions of countries can be compared on the global scale. Look again at the Activity 1 graph. How many times does US or Germany emit more CO<sub>2</sub> than India?

### Two degrees, maximum!

Climate Change cannot be stopped. The greenhouse gases which are in the atmosphere at the moment will inevitably warm it by 0.8 degrees more. What we need to do today is to abate global warming as much as possible to avoid its most disastrous impacts. Most scientists agree that keeping global warming below 2°C would prevent the worst.

For this, global emissions would have to peak during the next five to ten years and compare to 1990 have to be cut by approximately 75 percent by 2050. The global CO<sub>2</sub> emissions will have to be reduced from 5.5 t CO<sub>2</sub> per capita at present to approximately 1.5 to 2 t CO<sub>2</sub> per capita in 2050. But how to achieve this?

### How to abate Climate Change?

Today, 70 percent of the global greenhouse gas emissions origin from energy use. This is where drastic changes have to be made.

First, most of our electricity has to be produced from non-CO<sub>2</sub> emitting sources like renewable energy.

Second, we have to use our energy much more efficiently. From the production and transportation of our goods, the way we travel, the energy consumption of our gadgets at home and the insulation of our houses: energy has to be saved wherever possible.

Third, destruction of forests has to be stopped worldwide and new forests have to be created.

To achieve the first and second goal, it is especially important that people rising from poverty and demanding energy are directly provided with clean energy and leapfrog fossil fuels and inefficient technologies. Rich industrialised countries must provide a lot of money to make this possible.

## Activity — 3

### Sum it up

Is your head buzzing from all these facts and figures? Let us sum them up. Go through this Activity Sheet again and complete the boxes!

### Climate Negotiations: How close are we to the aim?

What is the situation now?	What has to be done?	Aim: A future world with an intact climate
Global per Capita CO <sub>2</sub> Emissions:		Global warming limited to:
Origin of Energy:		°C
Global CO <sub>2</sub> emissions equally or unequally shared?		Reason for limit:
Consequences of not abating climate change?		Global per Capita CO <sub>2</sub> Emissions:
		In 2050 total global CO <sub>2</sub> emissions compared to 1990 are reduced by:

Since 1995, the countries of the world are discussing how to abate and adapt to Climate Change. In 1997, they agreed on the Kyoto protocol which asks the industrialised countries to reduce their emissions by six to eight percent in 2012 compared to 1990. These commitments are by far not enough to keep global warming below 2° C.

The recent climate talks in Copenhagen and Cancun have not been able to come up with a solution. The hot bed of discussion is: Who will reduce how much emission? By 2050, total greenhouse gas emissions will have to be reduced by approximately 75 percent below the level of 1990 to limit global warming to 2° C. Developing countries like India will further claim their right to develop which will

increase greenhouse gas emissions. At the same time industrialised countries are not willing to give up their luxuries and reduce emissions drastically.

The present status of climate negotiations is that countries voluntarily set themselves reduction targets. The unbinding targets set so far would lead to global warming of 3 to 4° C.

#### Activity — 4

##### Climate Negotiations: Do it yourself

Are you also wondering why the global negotiations are so slow and reluctant? This Activity might give you an idea! Get Back to Activity 1 where you calculated the per capita CO<sub>2</sub> emissions for your commute from and to school. Now discuss and decide upon a reduction target. Think about ways to reduce your joint emissions to that target. How could students who commute to school by CO<sub>2</sub>-intensive modes of transport reduce their emissions? Are they willing to reduce them? Share your results with us and tell us how your negotiations went and if you have reached your emissions target! What is your master plan for a global solution?





***A drowning river: Yamuna submerged in garbage***



# Natural resources

How to share and care

# 'Environment... environment'.

**PANDITJI:** OOOFF!! You stumble on it anywhere you go. It crops up in every conversation you have and in everything that you do. Environment must be the **most** frequently used word in our vocabulary these days.

**SHAMIK:** (*Scratching his head, looking surprised*) And you are grumbling about that? Why Panditji, I would have thought you would be thrilled to hear people use the E-word so often. Haven't you always told us that Environment is what drives our lives and livelihoods?

**PANDITJI:** Yes, of course, I have, and I will still say that. At the top of my voice!

**GODHULI:** Err... so why were you roaring like an angry lion just now, complaining about the word being used too often and by too many people?

**PANDITJI:** I am not angry, I am disappointed. Because even after so much tom-tomming about 'all things ecological', I meet people who believe that environment is about trees, mountains, forests, animals and threatened ecosystems. Stuff that (they feel) are exotic and exclusive and have little to do with everyday life. They still haven't grasped the fact that Environment is about water, about land, about air and about energy too.

**SHAMIK:** . But Panditji, we do know that. Environment is literally the entity on

which we all subsist, and on which our agricultural and industrial development ... in fact, our entire economy... depends. This is especially true for India, right?

**PANDITJI:** (*looking happier now*): Ah, you are good kids. You have learnt our lessons well. I only wish rest would think like you too.

**GODHULI:** But they are beginning to, Panditji. Don't we hear people's voices being raised everyday in protest against ecological destruction? Local communities and groups, sometimes in the remotest corners of India, are ready to take on powerful government agencies, or even corporates wielding massive money and muscle strength. Why? To stop them from destroying their forests, polluting their air or dirtying their water. Surely this is environmental awareness of a very fundamental kind!

**PANDITJI:** (*Nodding vigorously*) Yes, yes, yes. But let me tell you a secret. They are not fighting to protect the water, forests and air because they want to emerge as green heroes. They are battling it out simply because they don't want to lose control over the environment within which they live. So their main concern is about 'how should the environment be used and who should use it and benefit from it.'

**SHAMIK:** Panditji, I have to confess that I have been a bit confused lately. Why must there be a battle every time? Aren't the government authorities and the industries coming in with ambitious plans of building factories, plants, roads and mines? These development projects are bound to boost the local economy. And benefit the locals too.

**PANDITJI:** Ok let me explain. India is very densely populated. So much so

that there is hardly any ecological space left here today that is not being used. Every patch of wasteland, every inch of the coastlines, the most degraded forest zone ... explore and you will find it supports a human group... mostly the poor. Now if in the name of development a more powerful group muscles into that territory, destroying or transforming that space, then those who were earlier dependent on it are bound to suffer, right?



# What is all this noise about?

**GODHULI:** Does that mean our main problem is our ever-expanding population? Because there is simply not enough to go around?

**PANDITJI:** (*Shaking his head thoughtfully*) That's not entirely true. India is still in a position to feed twice its existing population. But only if its resources are properly managed.

**SHAMIK:** And now they are not?

**PANDITJI:** Can't you make that out yourself? Millions of

hectares of farm land are eroded thanks to badly planned irrigation systems and randomly used chemical fertilisers. We are counted among the largest exploiters of groundwater in the world, with more than two-thirds of our country getting seriously parched.

**GODHULI:** (*Waving her hands in agitation*) Oh our villages are in a bad state!

**PANDITJI:** You stay in a city and you are not much better off, Godhuli. You see, when villages become unlivable the cities turn

unlivable too because the rural population is forced to migrate to cities, in search of alternative livelihoods. Then pressure builds up on the cities. They are overcrowded and dirty, dotted with shanties which don't even provide basic sanitation facilities. Rotting refuse piles up on streets.

**SHAMIK:** Cars pile up too. Have you experienced one of those never-ending traffic jams lately? Why, oh, why do people buy cars or two wheelers... isn't driving on these roads a nightmare?

**PANDITJI:** Give them a good transport option, and they might. But our public transport system is so inadequate and so badly managed!

**GODHULI:** And we are paying a heavy price for the overload of cars, Panditji. Aren't some of the worst cases of outdoor air pollution found in Indian cities today?

**SHAMIK:** (*Holding his head*) Can't we do anything about the mess?

**PANDITJI:** Of course we can. I have told you already, this scary resource crunch is only because of sloppy management. And you cannot blame the government alone for it. We are equally responsible for this mess. We are happy to let a handful of people take all the decisions on our behalf.

**SHAMIK:** You are talking about the government

system. But how can we force ourselves into the closed chambers of the policy makers?

**PANDITJI:** We don't have to. It is our right to know what 'development' projects are coming up in our neighbourhood. The authorities are bound by law to take permission from the local communities before building any new factory, plant, road or mine. And if they decline, the work has to stop.

**GODHULI:** Really? Then why do these protests erupt at all?

**PANDITJI:** Because till now, these rights were not being exercised properly. And each one of us have to be blamed for that. The Indian democracy is one of the most vibrant in the world. And the responsibility is on each one of us to use the platform it provides.

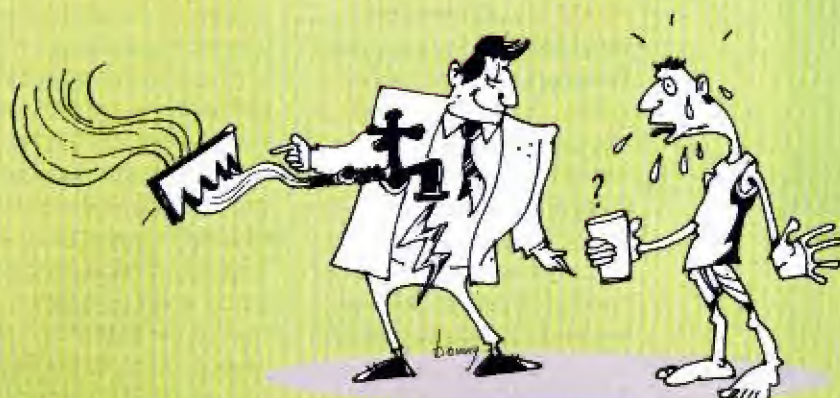
**SHAMIK:** (*excitedly*) Come to think of it, how many of us really know about our rights? Or our responsibilities? I want to Panditji. Please tell me how.

**PANDITJI:** (*smiling*): There is just one way to go. Understand the relationship between you and the environment you live in. Learn this lesson well and you can help India overcome its biggest challenge: to find a development process that brings about growth by sharing the benefits equally among all. In a sustainable way. Here, let me help you take the first step...



# 1 Water

- Who thinks about water conservation while flushing? Not you, right? You would, if you knew how much fresh water is converted into waste each time you use the toilet.
- Ever thought about how rivers are losing their ability to clean themselves because of all the waste we dump into them?
- Almost 75 percent of the earth's surface is covered with water and we are still struggling to procure freshwater. Wonder why?
- You have sure learnt about so many large dams operating across the globe. But has anyone told you how they trigger devastating floods that sweep away people, animals and arable land?





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Water?



Most of us are tired of grumbling about water. Every time we think about it we are reminded of the long wait for that trickle of water from the municipal supply or the fight for a fair share from the water tanker. Even in a 'good-monsoon' year! Will this water crisis haunt us forever? We must be going wrong somewhere... It's time to take stock of the situation. It's time to find out how this crisis is generated. How are we using water? Is there anything we can do to manage it better? Can we make sure that the monsoon rains bring us some relief? This summer, as the crisis arises again, let's understand water usage and find out different ways of tackling water shortage.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be given to primary and upper primary students to do after the completion of Science and Geography lessons on water as a resource. These activities can be a good energiser before monsoon season and before starting lessons on rainwater harvesting.

### Activity — Lets Go...

#### School Water Trip

Ask your teacher if you can go on a school water trip? Start your adventure by first finding out the source of water, municipal or otherwise, for your school. Find out that single pipe which supplies water to the whole school. If possible have a look at the point where it joins the main municipal supply line. Just gauge the diameter of the pipe used. Trace this pipe around your school.

Where does it go first? .....

How does the water get distributed in the school?

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.....

Does the diameter of the pipe increase or decrease as it moves around the school?  
Increase/Decrease

(It would be helpful if you take a person from the administrative staff along with you.)

Does the school have a water meter?

☐ Yes ☐ No

If yes, what does it look like? Draw it.



What are the measurement units of the water meter?

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What is the name of the institution supplying water?

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Dig up the water bills of your school. Check out the rate of water per unit consumed.

Photocopy the bill and attach it to the activity sheet.

### Down The Drain

Trace the path water takes after being used in the water fountains or washrooms. Where does it go? It would be great if you can actually have a look at the main drain pipe which spits the dirt of the school.

Yuck! Why would I like to see such a dirty thing?

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Well, just to know your contribution to the society. Or is it environment?

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Draw a rough map of the water flow into and out of your school with major stops like overhead tanks, washrooms etc.

If possible, try and trace the path of the drain and see where it finally ends up – obviously into the sea – but surely it would be an adventure to see how it travels. If the school cannot arrange it – try to convince your parents to take you on such a trip

### Raindrops

Has this ever happened – its raining and you are waiting desperately for it to stop because you want to play. Well, next time it happens try this out! (Of course ask your parents first.) Wear your raincoat and take your umbrella. Go out and follow the trails of water everywhere. After the rain falls on the roof where does the water go? Does it carry anything along? What?

See if you can collect some rainwater falling from some drainpipe. Store it in a can and keep it in a safe place. After a few days when your plants require water, you can use this.

Notice the following:

What are the mechanisms/paths humans have made to get rid of the water being collected everywhere?

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Can this rainwater be put to use? How?

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Look at the child. What do you think he is doing?

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### Experiment

The average annual rainfall in Delhi is 611mm – you must have read this in books, newspapers or heard it on radio or television. The meteorological department must be having some apparatus to calculate how much it rained during the year.

### Measure the amount of rainfall

Next time rain is forecast or you know that it would start raining any moment, start this experiment. Get a glass or tumbler with uniform dimensions and place it on your terrace or open ground away from any wall. Make sure water running from any other sources is at a distance from your tumbler. After the sky is clear and the rain stops, go and pick up your tumbler and see the amount of water it has collected. Measure the height of the water in the tumbler and you'll get, guess what? – the approximate average rainfall on that day.

Hey wait! Your experiment isn't over yet. Call up the local meteorological office and ask for the day's rainfall figures.

Although you are not using the same apparatus as the MET officers are, your figure would surely be approximately the same as theirs. Hurray! Ready to be a meteorologist?

If you are in school, you can ask your teacher's permission to do the same experiment.

Now, if you know the rooftop, paved or unpaved area, you can find out the water you could have harvested on that day. Refer to HOW GREEN IS MY SCHOOL? A DO-IT-YOURSELF MANUAL, Pg. 14-15. Visit [www.rainwaterharvesting.org](http://www.rainwaterharvesting.org) for more details.

Interests: Watching Cartoons, Basketball and sleeping

In no time it was evening and he realised that he had to finish some of the chores his parents had given him. He quickly cleaned up his room and ironed his clothes. And then he went into the bathroom and realised that he had left the tap open and all water in the overhead tank had run out. There were just two buckets left in the bathroom and he had a lot of washing to do. Washing dishes and his cycle would alone take one-bucket each. How would he water the plants which required two more? He was sure he was going to get into trouble with his parents and would not get his computer too. He began to cry. Can he finish these tasks with two buckets? Can you help Rahul? What would you do? Be realistic.

[illegible]

**Whom does water belong to – the government or people? Log on to [www.gobartimes.org](http://www.gobartimes.org)**



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Fresh water?



Water experts estimate that the fresh water supply on earth is the same as it was 2,000 years ago when the population was three percent of its current size. Nearly half a billion people around the world living in 31 countries – mostly in the Middle East and Africa – currently face water shortages. By 2025, this number will increase five-fold to 2.8 billion people – 35 percent of the world's projected total population of eight billion people. Another 17 countries, including Ethiopia, India, Kenya, Nigeria and Peru will be pushed onto the list of countries likely to run short of water. China and Pakistan are also expected to approach water stress.

Name .....

Class ..... Date .....

**Curriculum Connect:** These activities can be given to upper primary students to do after the completion of Science and Geography lessons on water as a resource. For the secondary students these activities can be given before introducing History lesson on civilisations.

### Gobar Gyan

Water is one of the most amazing substances on our planet. Did you know that every single living thing needs water? It is in each one of the cells in our bodies and in the bodies of all plants, animals and other creatures. Water is special because it can mix with many different liquids and solids. Its ability to stay warm for a long time helps keep the temperature inside our bodies at around 98 degree Fahrenheit. It also helps keep the temperature of oceans, lakes and rivers from changing very quickly.

### Activity — 1

If you can answer the questions given below you can find out the per capita water consumption in your house:

**Note:** You can ascertain the quantity of water used in a calibrated tank by measuring the fall of water level (consult your parents). If the water in your house comes from a common tank then you can find out the per capita consumption of fresh water by assessing different uses.

You will have to take a calibrated container like a bucket that can hold 20 to 30 litres of water.

For usage of water directly from the tap you will have to ascertain the flow by pouring it into calibrated buckets and multiplying it by the time for which the tap flows. This exercise will help you derive, approximately, the quantity for each use. Different uses could be bathing, washing, cleaning etc.

1. How many individuals stay in your house?

\_\_\_\_\_

2. How much water is used in your house?

\_\_\_\_\_

3. What is the per capita water consumption in your house?

\_\_\_\_\_

**Remember!** Divide the total quantity of water consumed by total number of individuals living in your house.



4. What are the sources of water in your house?

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Remember! Consult your parents and/or the estate manager of your area.

5. Identify different uses of water and their quantities.

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Remember! Consult your family members and people who work in your house.

6. Identify the approximate quantity of water you can save in each use.

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Remember! Consult your family members and people who work in your house.

7. List the changes you plan to introduce to save water. For example, replacing leaking tanks, taps, pipes etc.

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After 15 days answer the first five questions again to find out how much water you have saved.



# Green Schools Network

## ACTIVITY SHEET

### Why talk about River pollution?



Well we know everything about it. It has been happening for years now. We even went to the local river and cleaned it up – our own river pollution action programme. We know that the culprits are industries which dump effluents in the rivers and make them dirty. Also, the culprits are people who live by the banks of the river and do their 'bad stuff' next to it and even wash clothes in it. Ya! I remember, the school even did a campaign around the issue and we put up posters in the area to make people understand that they shouldn't throw things into the river. Isn't that the entire story of river pollution? Well ... not really! And that's what we explore in this activity. We find that it's not only people living by the banks or the dirty industry guys who pollute the river, it's also us...

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be given to the upper primary students to do after the completion of the Science chapter on river pollution. For the secondary students these activities can be given after completing Science and Geography lessons on waste water.

### Gobar Gyan

Traditionally, cities, towns and even villages settled keeping in view the water requirements and it would not be a gross generality to say that most of the cities and towns are actually settled alongside rivers, rivulets, lakes or other water bodies. Fresh water was taken from upstream and the waste given out downstream.

Rivers have an intrinsic capacity to clean themselves but this capacity was overloaded when cities grew in size and the amount of waste dumped into the rivers went up.

### Activity — 1

Find out the river/rivulet that flows next to your city/town or village. If there isn't one, you are sure to find a lake in your city.

Name of the river/rivulet/lake/water body: .....

Many people live in cities by rivers but, unfortunately, not many of us have really seen our city river up close or touched the water of the river. Visit the river in your city. Talk to your parents or people around and find out where the water in the river/lake comes from? (Obviously it comes from upstream!)

.....  
.....  
.....

Does your city/town get its water from the same river/lake? (You may have to call the agency which supplies water to your house to find this out.)

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.....  
.....  
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Where does the wastewater of your city end up? Call up the Municipal Corporation or better still trace the water from your home to the colony – out of the town.

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## Gobar Gyan

While industries and people throwing garbage are obviously sources of pollution, nearly 80 percent of river pollution in India is due to excreta! And who is responsible for all this? Not those who defecate in the open because they have no access to toilets but those who have toilets – the middle class and the affluent. This is because with every flush we use more and more clean water to dispose our faeces and urine (over 10 litres), increasing the quantity of sewage.

So, the rivers are full of this muck. What say? So, the next time you do a campaign in a slum near a river, remember, it's your colony that needs a campaign — to make people aware of the ill effects of flushing. Many people are now working at toilets which do not require water for flushing.



## Activity — 2

Go to the toilet of your house and measure the volume of your flush tanks:

Volume of flush tank no. 1 = \_\_\_\_\_

Volume of flush tank no. 2 = \_\_\_\_\_

Volume of flush tank no. 3 = \_\_\_\_\_

Now, do a task you have probably never done before in your life. On one holiday, when you are at home, find out how many times people flush in a day and find out the total amount of water used.

Number of times the flush was used = \_\_\_\_\_

Total water flushed = Number of times the flush was used X volume of flush tank = \_\_\_\_\_



Now, based on an estimate of the number of people in your colony you can actually estimate the amount of water going down the sewage drain in your colony.

Go to a nearby shop that sells sanitary fittings for toilets and bathrooms and ask them if they have any equipment which uses less water? How does it work?

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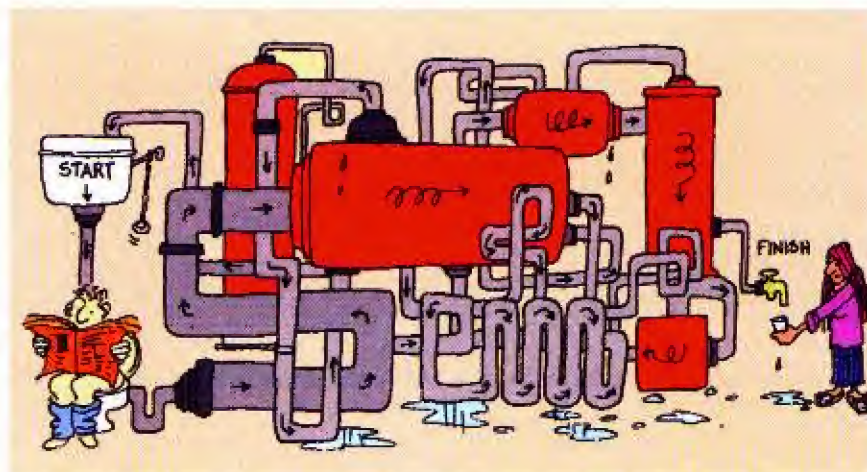


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## Gobar Gyan

Logically, all the sewage from the colonies need to go to units called the Sewage Treatment Plants or STPs. The sewage is treated here before being released into the river so that the river is spared the pollution load.

But there are a few problems here. Firstly, there are not enough STPs to treat the sewage generated by the city and secondly, even the existing STPs aren't able to do much as there are problems in transporting the sewage to these units.



### Activity — 3

It would be a good idea to actually visit a STP in your city/town. Call up the municipal body and find out the location of the STP and note down its telephone number.

Call up the manager of the STP and tell them that you would like to visit. You can also ask your teacher to arrange a visit to the STP.

Where is the STP located? (near the river or in a place far away)

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Speak to the engineer on site and ask the following questions:

What is the total capacity of the STP?

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How is the sewage that reaches the plant treated? (The various stages)

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Make sure you have a look at the point where the sewage enters the plant and the point where it is disposed off into the river or a nearby water body.

Find out the number of STPs in your town/city

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## Activity — 4

Any river or water body would have a certain number of people depending on it for their livelihood. They would be the best people to tell you about the real effects and causes of river pollution. And it's fun to interact with them. Approach a fisherman/woman, boatman/woman or a farmer by the riverside and find answers to the following questions:

Name: \_\_\_\_\_

Profession: \_\_\_\_\_

How long has s/he been in the profession? And what changes did s/he find in the condition of the river?

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What, according to them, are the major sources of pollution of the river?

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What kinds of birds/fish or other living beings are found in the water?

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After collecting information from the above sources think of a campaign you can do on river pollution in your city/town. Click photographs while you are interviewing people and share your interviews with schoolmates and the larger community. Use films on river pollution to generate awareness. 'Faecal attraction' is a film produced by the Centre for Science and Environment, New Delhi, which speaks about a variety of issues on river pollution. Do write to us to know more about the film.





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Dams?



Dams are symbols of modernisation. Over 48,000 large dams are in operation worldwide. And more are being built to provide drinking water, irrigate land, produce hydropower and prevent floods.

#### Yet today:

- Over one billion people do not have access to safe drinking water
- More than double that number lack basic sanitation
- Two billion people have no access to electricity.

And those numbers are poised to rise. To meet the growing demand for water and energy, more large dams are being proposed as a key solution.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be used by secondary and higher secondary students for Science, Economic and Sociology lessons on development and management of natural resources.

### Gobar Gyan

For some time construction of dams had slowed down as decision-makers learned about their harmful effects. But in recent years, the number of new dam proposals has skyrocketed. You might say: 'Yes, I know that'. You might also wonder what you have, as student, got to do with large dams. Let me ask you a few questions. Finding answers to them will make you discover how you are connected to dams.

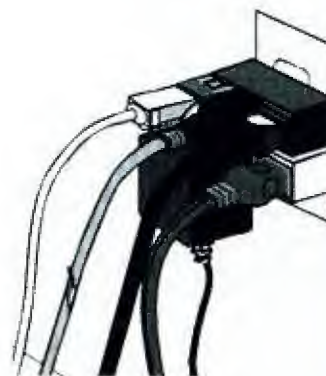
#### Activity — 1

If you live in a city you get running water in your bathrooms, electricity to run your appliances and of course the best of the food you can get in the market. Even people who live in the rural areas get electricity for a while and water to grow crops in their fields. Where does all this water and electricity come from? Ask your parents, elders, teachers, people at the electric sub station, people at the central water tank and the vegetable vendor in the market. Look beyond the apparent sources.

Water: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Electricity: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Food: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



## Gobar Gyan

As we have seen, dams are associated with two crucial aspects of our life – water and electricity – and these two are associated with our very existence. In India most of the large dams are built by the National Hydroelectrical Power Corporation (NHPC) and the irrigation department.

### Activity — 2

Play the role of an inquisitive researcher. Use the internet to find out more about large dams. Read about both the positive and negative aspects of dams that are available on the web. Write them down in the space given below:

Good things: \_\_\_\_\_

\_\_\_\_\_

Bad things: \_\_\_\_\_

\_\_\_\_\_

## Gobar Gyan

If information gets fuzzy and you are confused seek guidance from your teachers and elders. Do not accept their opinion as the final verdict. Find out more and try to build an opinion about big dams based on your research. What you think about big dams also defines the kind of person you are.

### Activity — 3

Now that you know so much about big dams express your opinion in the space given below. Write down why the big dams are good? And why are they bad? In the conclusion section write down the final verdict, weighing all the pros and cons. Take into count everything, that is, the amount we invest in them, the returns we get, their efficiency, what happens in case of natural disasters, their impact on the environment and people.

Big dams are good because: \_\_\_\_\_

\_\_\_\_\_

Big dams are bad because: \_\_\_\_\_

\_\_\_\_\_

Conclusion:

\_\_\_\_\_





- A temperature increase of only one degree Celsius caused by CO<sub>2</sub> emissions could lead to more than 20,000 deaths. Now, think about all the CO<sub>2</sub> emissions you cause in your day-to-day chores.
- Every km you walk or cycle, you exhale 3 gms of CO<sub>2</sub>. And if you happen to travel the same distance by a diesel car, you would be adding 208 gms of CO<sub>2</sub> to the atmosphere.
- In India, 1,727 billion tonnes of CO<sub>2</sub> were emitted in 2007. And the volume keeps increasing.
- The 25-km long Gangotri glacier is retreating by more than 16.5 metres every year. If this continues, it won't be long before the entire glacier disappears.

**Want to know more?**



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Carbon dioxide?



Carbon dioxide ( $\text{CO}_2$ ) is one of the primary greenhouse gases produced by human beings through combustion of fossil fuels such as coal, oil and natural gas in power plants, automobiles, industrial facilities and other sources.

Earth's atmosphere has probably always contained  $\text{CO}_2$  in varying amounts. This GHG allows light radiation to pass through while absorbing some of the heat radiating the earth's surface. This causes the earth's surface and atmosphere to be 33 degrees Celsius warmer than it would otherwise be. But things have drastically changed after the industrial revolution; large-scale burning of fossil fuels along with deforestation has caused increasing atmospheric  $\text{CO}_2$  levels (up to 40 percent). This has led to an enhanced greenhouse effect and consequent climatic change.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be taken up after the completion of Science and Geography chapters on Air Composition and Climate Change. They will help secondary and higher secondary students understand their contribution to pollution.

### Gobar Gyan

#### What goes around comes around!

While  $\text{CO}_2$  maintains the greenhouse effect of the earth keeping the earth warm, an increase in the amount of  $\text{CO}_2$  in the atmosphere has led to global warming. The climate change that takes place due to an increase in the  $\text{CO}_2$  concentration is largely irreversible for 1,000 years after emissions stop.

$\text{CO}_2$  emissions don't just cause global warming, they are also a major source of air pollution. Scientific experts now believe the world faces an epidemic of illnesses that are exacerbated by air pollution. These illnesses include cardiovascular disease, asthma, chronic obstructive pulmonary disease, lung cancer and diabetes. Our transport vehicles are largely responsible for these harmful  $\text{CO}_2$  emissions in the atmosphere that cause air pollution and climate change. But we need transport for movement, so how do we control these emissions? Are we going wrong somewhere? Let's find out.

Type of vehicle	$\text{CO}_2$ emissions per km	Distance between your house and school in kms	$\text{CO}_2$ emitted each day: ( $\text{CO}_2$ emissions per km x kms traveled x no. of trips made)
Two wheeler	28gm/km		
3 wheeler	78gm/km		
Diesel car	208gm/km		
Petrol cars	223gm/km		
Mini Buses	300gm/km		
Large buses	515gm/km		

#### The $\text{CO}_2$ facts:

- While Bhutan, Afghanistan, Nepal, Zimbabwe, Sri Lanka, New Zealand and Hong Kong emit 0.1 percent of the total  $\text{CO}_2$  emissions, US alone contributes a 22.2 percent (the highest!). India ranks 5th with 4.9 percent.
- A Stanford University study has found that for each one degree Celsius increase in temperature caused by  $\text{CO}_2$  emissions, the resulting air pollution could lead to more than 20,000 deaths worldwide every year with many more cases of respiratory illnesses and asthma.

**Example:** If you use a diesel car to go to school, which is 6 kms from your house, you emit 208gms x 6kms x 4trips\* = 4992 gms (approx. 5 kg) of  $\text{CO}_2$  in one day. (\*Remember, each time you are dropped off at school, the driver has to drive back. So there are two round trips a day.)

However, if you take a bus to school, the amount of CO<sub>2</sub> emitted by the bus would be shared by 50 people, that is, the average seating capacity of the bus. Therefore, if your school is 8 kms away, the total CO<sub>2</sub> emissions made by you are: 515gm x 8km x 2 trips = 8240 gms = 8.2 kgs

$$\text{Emissions per person} = \frac{8240}{50} = 164 \text{ gms!!}$$

### Compare your results with your class.

In cities across the globe, the personal automobile is the single greatest polluter as emissions from a billion vehicles on the road add up to a planet-wide problem. Driving a private car is a typical citizen's most air polluting activity. The negative effects of automobile emissions are maximum when you sit in traffic surrounded by cars, their engines idling. Everyone in a traffic jam is getting poisoned and our atmosphere, choked.



Vehicles with poor gas mileage contribute the most to global warming.

The only way to save us from this ongoing 'self-destruction' is to reduce the number of vehicles on the roads by switching to mass transit. Your calculations from the above activity would have revealed the same. Mass transit systems are not just environment-friendly but also more energy efficient.

All governments invest a huge amount of capital in the public transport industry for the convenience of its people. Name the public transport available in your city. Tick the ones you can use for commuting to school. Calculate the carbon emissions for each one of them and compare the results with those of your private vehicle.

Public Transport		Transport I can use		CO <sub>2</sub> emissions	
1. _____	2. _____	1. _____	2. _____	1. _____	2. _____
3. _____	4. _____	3. _____	4. _____	3. _____	4. _____

**The 'Reduce Carbon Dioxide eMission'!!** (1 pound = 0.453 592 37 kilogram)

- **Reduce the amount of emissions by walking, biking, carpooling or taking mass transit wherever possible:** Avoiding just 16 kms of driving every week would save about 500 pounds of CO<sub>2</sub> emissions a year! Walking and biking will also keep you fit. *Ask your parents to keep their cars tuned up, check tyres weekly to make sure they're properly inflated, and when it is time for a new car choose a more fuel-efficient vehicle.*
- **Support local farmers' markets:** They reduce the amount of energy required to transport food to you by one-fifth and you also get to save good money. Try and buy organic foods as much as possible.

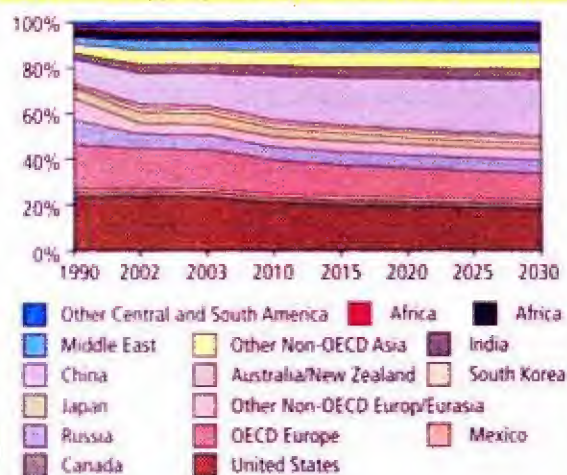
You could also do a quick check at home and save a lot more CO<sub>2</sub> emissions that originate in the household.

**Go for compact fluorescent (cfl) light bulbs and tube lights:** Save 60 percent energy (and your money) and about 300 pounds of CO<sub>2</sub> emissions a year.

- **Clean/replace filters on your furnace and air conditioners:** Save 350 pounds of CO<sub>2</sub> emissions a year. It also ensures faster cooling.
- **Choose energy efficient appliances** when making new purchases.
- **Use less hot water:** Heating water takes up a lot of energy. Use less hot water by installing a low flow showerhead (350 pounds of CO<sub>2</sub> saved per year) and washing your clothes in cold or warm water (500 pounds saved per year).
- **Use a clothesline instead of a dryer whenever possible:** Save 700 pounds of CO<sub>2</sub> emissions in six months time.
- **Turn off electronic devices you're not using:** This will save us thousands of pounds of CO<sub>2</sub> emissions every year.
- **Buy recycled paper products:** It takes 70 to 90 percent less energy to make recycled paper and it also prevents the loss of forests, which are 'carbon sinks' worldwide. Besides, these products are more aesthetic and presentable.

**Projected share of CO<sub>2</sub> emissions, by country**

Mongabay.com using data from EIA 2007



The Kyoto Protocol, a protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), establishes legally binding commitments for the reduction of four greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride), and two groups of gases (hydro fluorocarbons and per fluoro-carbons) produced by the industrialised nations as well as general commitments for all member countries.

A carbon footprint is "the total set of GHG emissions caused directly and indirectly by an individual, organisation, event or product."



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Global Warming?



How does it matter if the earth gets warmer by one or two degrees? Life still goes on, right? Now, remember the last time you had fever. Your body temperature must have been 99 or 100, just 1 or 2 degrees above normal. Did life still go on? NO! It's high time we realise that earth's got fever and we don't have any medicines. We just have to take care of it.

We are adding gases to the atmosphere that have a craving for heat and trap it — greenhouse gases (GHG) like mainly carbon dioxide ( $\text{CO}_2$ ), methane and water vapour. How?

Primarily by using carbon-based fossil fuels like coal, gas and oil, as we go about doing our daily business, perhaps!

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be taken up after completing Science and Geography lessons on environmental pollution. This sheet will help upper primary, secondary and higher secondary students understand the causes and effects of pollution.

### Gobar Gyan

Remember the last time you parked your car in the sun and came back later, into 'an oven of a car'. The temperature inside the car increases as the heat is trapped inside, while the windows are closed (is it the greenhouse effect?). Well, most often we immediately open the windows of the car to bring the temperature down. But how will we open the windows when the same thing happens to our earth?

### Activity — 1

Find out: How do people in your class commute to school?

Mode of Transport	No. of Students Travelling
Walking	_____
Cycling	_____
School Bus	_____
Private Bus	_____
Personal Car	_____
Others	_____

What do the above numbers tell you? Do they reveal any patterns?

Compare this data with a neighbouring class. Can we, as school students, do something to reduce the GHG emissions?

### Gobar Gyan

If travelling by bus produces the least amount of  $\text{CO}_2$  then why don't people travel by such means? What stops people from travelling by mass transit? It is surely a matter of research. Also, cycle would be such a fine means of transport but one doesn't find many of them on the roads these days. Why? Find out.



## Activity — 2

Interview a few people around and find out if they would be ready to switch to non-emitting sources of transport, like bicycle for shorter distances. Ask what stops them from using such means? Note down your experience here:

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### SUNDAY CAMPAIGN:

Arrange a Sunday cycle rally – call all your friends for a picnic and cycle to the spot. Ask elders in your colony to join in. Encourage people to at least use cycles on Sundays to go to the nearby market. Let Sunday be a Cycle Day.



### Negotiate:

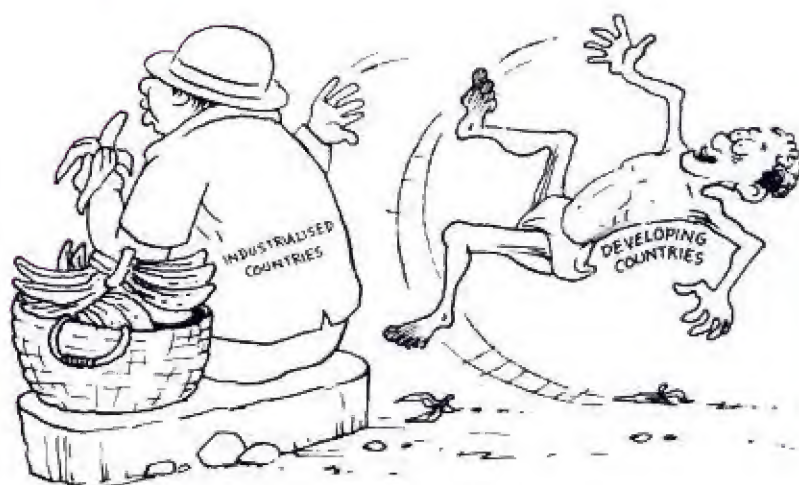
Have a class meeting after listing every individual's mode of transport. Try and come up with a plan whereby the overall gas emissions of the class can be brought down. Negotiate with people who use their personal vehicles. Share the responsibility of tackling global warming jointly as a class.

How easy is it to convince your friends to reduce emissions? You would be surprised to know that something similar is happening at the global level.

## Gobar Gyan

The negotiations going on at the UN Framework Convention on Climate Change (UNFCCC) aimed at cutting down GHG emissions will surely be on the same lines as your classroom negotiations. The basic negotiations are between the developed countries and the developing countries. While the developed countries refuse to cut down on their luxuries, the developing countries don't want to compromise on industrialisation, as their main focus is development.

And hey! Do share the proceedings of the negotiations with us – May be your class could have the best deal to offer to the world.



## Activity — 3

### Find out

Heard of Siachen Glacier, the highest battle ground in the world? Find out how people are staying out there. Find out if there are other inhabited glaciers in the world?

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## Activity — 4

River	Source
Yamuna	
Ganga	
Sutlej	
Narmada	

[illegible]

**Experiment:**

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The United Nations Intergovernmental Panel on Climate Change (IPCC) has come up with a report on Global Warming. It terms human activity as a 'very likely' cause of climate change and global warming. Read the report on the internet or as briefs in libraries, newspapers etc and list the 'human activities' below.

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The likely results of Global Warming are also mentioned. Does it just mean that we would have warm winters and hotter summers? Find out for yourself.

GobarTimes

## Green Schools Network

## ACTIVITY SHEET

Why talk about  
Glaciers?

Rivers of ice. Great walls of frozen snow that move, moulding and shaping the land as they go. Glaciers are certainly one of the most spectacular visions on our planet.

Yes, glaciers are powerful. But they are also vulnerable to conditions like changes in climate. How? Well, greenhouse gases (GHG) like carbon dioxide ( $\text{CO}_2$ ) and methane heat up the earth like a garden green house. The surface temperature rises and glaciers melt as a result of the rising heat.

Maybe you are asking yourself, why should I care about that? You should. Because glaciers play a vital role in our lives. Let's find out how closely they are linked to us!

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be taken up by students of all grades as a follow-up on Geography and History lessons on water resources.

## Gobar Gyan

Glaciers cover 10 percent of the world's land area but store about 75 percent of its freshwater! As they need some specific climatic conditions to exist, they are mainly concentrated in regions above the snow line, that is, mountainous areas or the polar regions.

As glaciers are so sensitive to changes in temperature, they are used as barometers by scientists to study climatic conditions of the past ages and to find vital clues as to what may happen in the future. Absolutely fascinating, right? The bad news is that they paint a horribly alarming picture for planet earth. Since the early twentieth century, with few exceptions, glaciers around the world have been retreating at an unprecedented rate. In fact, some ice caps, glaciers and even an ice shelf have disappeared altogether in this century. The situation is getting grimmer with the balance of snow in the Himalayan glaciers reaching a particularly precarious state. Their snowline too is shifting steadily backwards. For example, the 25-km long Gangotri glacier, which is the source of the holy river Ganga, is retreating by more than 16.5 metres every year.



The glaciers, as they melt, are also breaking up. And the smaller fragments that replace the big ones are larger in number but carry far less volume of water.

## Activity — 1

## Go glacier hunting!

- Do you live near a river? Track its original source. Is it fed by melted glacier water?
- Do all rivers originate from glaciers? Get hold of India's river map and find out which of them flow out of glaciers and mark them with a red pen.

## Activity — 2

Get to know your glaciers better. Answer the questions below and find them in the crossword.

- The study or science of glaciers is referred to as: \_\_\_\_\_
- A glacier forms with the accumulation of \_\_\_\_\_ over time.
- The process of glacier growth and establishment is: \_\_\_\_\_
- The two common type of glaciers are continental ice sheets and \_\_\_\_\_
- The largest glaciers: \_\_\_\_\_
- Glaciers that terminate in the sea: \_\_\_\_\_
- A large piece of ice from freshwater that has broken off from a snow-formed glacier and is floating in open water: \_\_\_\_\_
- The only continent where no glaciers can be found: \_\_\_\_\_
- The planet other than earth which exhibits glacial features: \_\_\_\_\_
- If all land ice melted, sea level would rise by approximately \_\_\_\_\_ metres worldwide.
- The second longest glacier outside of the polar regions and largest in the Himalayas-Karakoram region: \_\_\_\_\_
- The most important factor causing glacial loss: \_\_\_\_\_
- A geological period of long-term reduction in the temperature of the Earth's surface and atmosphere, resulting in an expansion of glaciers: \_\_\_\_\_
- The glacier river Ganga originates from: \_\_\_\_\_
- The two major consequences of melting glaciers: \_\_\_\_\_



### The glacier alert!

- With Himalayan glaciers continuing to melt, in the short-term there will be an increase in river discharge causing floods in adjacent areas. But in a few decades, the water level of the rivers will decline to a permanent reduced level.
- The Himalayan glaciers are the source of water for rivers that flow across Indo-Gangetic plains. So the lives and livelihoods of the 500 million people who dwell here are completely dependent on these ice masses.
- The economy will suffer from this loss of water as industries like food and steel depend on the availability of water.
- The production of electricity through hydropower that depends on glacier-fed rivers may suffer a setback.
- Glacier melt, especially at the poles, has

G	L	O	B	A	L	W	A	R	M	I	N	G	U	D	A	S	E	H	W
L	M	J	F	R	O	T	I	U	A	T	W	N	I	A	S	R	S	U	A
A	W	D	S	I	N	H	Q	I	R	E	A	N	T	O	H	T	E	I	T
C	E	S	I	A	C	H	E	N	I	M	L	F	A	R	W	T	H	C	E
I	S	E	D	O	T	H	O	S	A	N	P	D	T	A	R	M	N	E	R
O	A	V	D	U	W	M	G	L	A	C	I	A	T	I	O	N	A	I	S
L	O	E	U	L	M	E	K	A	M	A	N	B	S	A	T	I	U	E	C
O	D	N	S	T	N	R	H	A	A	M	E	U	N	L	L	H	N	D	A
G	G	T	U	N	D	I	A	W	P	E	U	E	O	I	M	A	A	S	R
Y	B	Y	I	N	I	E	R	A	P	A	I	N	W	Y	B	D	U	A	C
A	M	D	G	A	N	G	O	T	R	I	E	Y	W	I	A	S	S	N	I
U	N	T	I	H	A	B	I	T	A	T	L	O	S	S	A	H	T	L	T
T	S	A	P	P	U	H	E	R	T	I	D	E	W	A	T	E	R	L	Y
I	E	M	A	T	M	E	M	E	I	C	H	A	V	I	L	E	A	H	L
J	U	E	O	S	H	H	A	Y	L	E	V	T	F	T	R	H	L	T	A
L	D	R	T	M	V	O	R	M	L	B	Y	S	S	E	W	M	I	A	L
S	L	C	U	I	C	E	S	H	E	E	T	S	L	I	C	E	A	G	E
A	E	U	O	B	E	V	E	V	L	R	R	U	S	L	I	T	E	U	
D	S	R	F	Y	E	E	G	P	E	G	N	H	R	A	E	H	A	K	F



contributed to as much as 30 percent of sea level change in the 20<sup>th</sup> century. A new report of the Scientific Committee on Antarctic Research (SCAR) suspects that sea level could rise up to 1.4 metres by the end of the century. This is a danger signal for the people living in coastal areas. Indian coastal cities like Mumbai, Chennai or Kolkata are likely to be affected quite severely.

- Glaciers absorb a little amount of heat, reflecting most of it back into space. If they disappear completely, the earth below will be dangerously exposed. It will now absorb most of the heat, reflecting back just a small amount. This will cause the earth to heat up even more. And the heightened temperature will hasten the melting of the remaining glaciers. A vicious cycle indeed!





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Aerosols?



Aerosols are a collection of tiny particles of solid or liquid substances suspended in a gas form. The most familiar form of an aerosol is found in pressurised spray cans like bottles of deodorant or mosquito spray. Aerosols contain particles called chlorofluorocarbons (CFCs), which damage the stratospheric ozone layer. These CFCs are also emitted from air conditioners, refrigerators, and other cooling devices.

Scientists are worried about the stratospheric ozone layer because it contains Ozone (triatomic oxygen) that filters out much of the sun's harmful ultraviolet radiation. CFCs are leading to the thinning and depletion of the ozone layer.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be taken up by secondary and higher secondary students after the completion of Science chapters on Air Pollution.

### Gobar Gyan

We have all heard about how human inventions like cars and factories are creating a large amount of pollution, leading to the degradation of our environment. A part of this pollution is caused by one of our most used inventions: 'a can of spray'.

### Activity — 1

How many times have you sprayed down that line of ants on the floor or used deodorants before leaving for your friend's birthday party? It is so convenient to use spray cans, is it not? Track down the items listed below in your house and write in the space alongside how many of each item do you have?

1. Deodorants \_\_\_\_\_
2. Paint and Varnish remover \_\_\_\_\_
3. Glass cleaning liquid spray \_\_\_\_\_
4. Paint \_\_\_\_\_
5. Mosquito spray \_\_\_\_\_
6. Hair Spray \_\_\_\_\_

All the above items contain aerosols. These aerosols, though not even visible to the human eye, are causing a huge damage to the atmosphere around the earth. When an aerosol particle comes in contact with the ozone layer, it can break down tens of thousands of ozone molecules before it is removed from the stratosphere.

### OZONE LAYER:

The atmosphere is a layer of gases that is wrapped around the earth like a blanket. It is made up of the following layers:

■ Troposphere ■ Stratosphere ■ Mesosphere ■ Thermosphere ■ Exosphere

Stratosphere contains relatively high levels of ozone (O<sub>3</sub>). This ozone layer absorbs 93-99 percent of the sun's high frequency ultraviolet light, which is potentially damaging to life on earth. In recent years, CFCs emitted from various human activities are leading to the thinning of the ozone. In fact, at places over the South pole, holes have formed in the ozone layer.

## Gobar Gyan

Apart from the damage they cause to the environment, aerosols are also harmful to human beings. Although they do not hurt our skin, these chemicals, if inhaled, can cause illnesses such as asthma and diarrhoea. Exposure over a long period of time can also lead to problems like headaches, nausea, shortness of breath, eye, throat and lung irritation, skin rashes, burns and even liver damage.

### Activity — 2

Talk to people in your house and neighbourhood who use spray cans to control pests and freshen the air. If possible talk to painters in a nearby furniture shop. Ask them the following questions:

Do you use canned sprays for your work?

If yes, then for how long have you been working with these materials?

Have you suffered from any unusual illness over the course of this time?

You may find that most people who use aerosol-based sprays suffer from many problems, especially those of the lungs, skin and liver.

## Gobar Gyan

In 1974, when it was discovered that aerosols harm the stratosphere, companies started coming out with products that were CFC-free. Today, many such options are available in the market. When shopping for household cleaners, polishes, hair sprays, and insect repellents, ask your parents to look for products sold as pump sprays, not aerosols. Buy refrigerators and air conditioners that do not use CFCs.

### Activity — 3

Now that you have tracked down all the aerosol-based sprays in your house, make a conscious choice and buy CFC-free products for your home. In the space provided below list how many aerosol products you could replace with aerosol-free ones.

#### Aerosol products you used

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#### Aerosol free product you replaced it with

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If you can't replace some of the products, here are some precautions you can take while using them.

- Always use aerosols in a well-ventilated area and do not inhale the vapours.
- Avoid misdirected sprays; it can harm the eyes and skin.
- Keep aerosol cans away from heat and flame.
- Dispose off the cans in your regular trash. Even though many of them are now made of recyclable materials, recycling centres do not usually accept them because they are inflammable. Never disassemble, puncture, or incinerate an aerosol can.

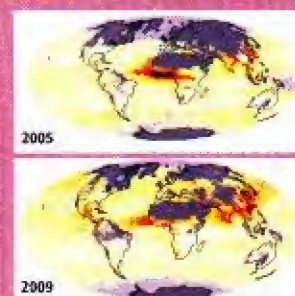


#### Aerosols:

These maps show average monthly aerosol amounts around the world based on observations from the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite.

Elevated aerosol amounts nestle at the foothills of the Himalaya Mountains for some months and linger over eastern China for much of the year.

Source: [http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MODAL2\\_M\\_AER\\_OD#](http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MODAL2_M_AER_OD#)





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Public Transport?



Public transport (public transit or mass transit) includes passenger transportation services available for use by the general public, as opposed to private automobiles or vehicles for hire. Public transportation includes subways, commuter trains, buses, van pool services, ferries, and monorails. Public transport is more cost effective than private transport. By stimulating public transport it is possible to reduce the total transport cost for the public.

The transport sector is by far the most voracious oil guzzler. By 2035, cars and road vehicles in India are expected to consume six times more fuel than they do now. The annual growth rate for cars in India is 16 percent. Cars consume six times more energy than buses, and two-wheelers, 2.5 times the energy. To carry the same number of people, cars occupy 38 times the road space than a bus, and two-wheelers occupy 54 times the space.

Name .....

Class ..... Date .....

**Curriculum Connect:** These activities can be part of Science as well as History subjects. Students of all grades will be able to undertake them.

### Gobar Gyan

The share of buses in the total fleet in India has dwindled from 11 percent in the 1950s to 1.1 percent today. This is visible in the use of road space. In Delhi, personal vehicles – cars and two-wheelers – use up more than 75 percent of the road space but meet only 20 percent of the commuting demand. But buses that use less than 5 percent of the road space, meet more than 60 percent of the demand.

Public transport systems mean lesser congestion and faster speeds. Investment in public transport also stimulates the economy.



### Activity — 1

Do you use public transport regularly?

Yes ☐ No ☐

If you travel to school using the school bus, then what is the bus fee?

\_\_\_\_\_

If you travel by your own vehicle then find out its monthly expense.

Distance between your house and the school: \_\_\_\_\_

Number of trips your car makes: 4 times per day

Total time taken to cover this distance (4 times): \_\_\_\_\_

Number of working days in the school in 1 month: \_\_\_\_\_

Now calculate the total distance

Total distance = Distance X 4 trips X Number of working days = \_\_\_\_\_

Find the amount of fuel required by your car to travel the distance between your house and your school.

Find out the mileage of your car: \_\_\_\_\_

Total fuel consumption =  $\frac{\text{Distance between house and your school}}{\text{Mileage of your car}}$

Calculate it here: \_\_\_\_\_

The monthly cost of the fuel required = Cost of fuel x no. of litres per month

Calculate = \_\_\_\_\_

If you have a driver then calculate his wage for driving you to school.

His hourly wage =  $\frac{\text{Monthly wage}}{30}$  X number of hours he works = \_\_\_\_\_

■ His wage for driving you to school = Hourly wage x travel time X 4 = \_\_\_\_\_

■ Total cost of travel = The car's monthly fuel + the driver's wage for driving you to school = \_\_\_\_\_

Which mode of transport is more expensive, public or private?

How much money would you save in a month if you made a switch from private to public transport?

How much money would your family/group of friends save if all of you decided to use public transport instead of using your private vehicles?

May be you could use all that money to buy something you've wanted for a long time!



## Gobar Gyan

It was the talk of the town. It had dominated newspaper headlines, TV news and all conversation had centred around it. What a chaos it had caused in Delhi! Why did we implement BRT if there were going to be more traffic jams?

BRT or Bus Rapid Transit is a system of transportation where the road is physically divided into separate lanes for vehicles to ply. There are separate lanes for buses, cars/two wheelers, cycles and walking – all made to increase the average speed of the traffic, especially buses. Bus stops are designed in the railway platform fashion.

But why not make flyovers and expressways, instead, to make traffic smoother? How is BRT going to help us? Let's explore through this activity...

## Activity — 2

Go to a busy road or junction near your school and observe the traffic (how it moves). Note the number of cycles, rickshaws, buses, cars etc. How many people travel by each means of transport? Write down your observations here:

Buses: \_\_\_\_\_

Cars: \_\_\_\_\_

Non-motorised transport (cycle, rickshaw): \_\_\_\_\_

What are your solutions for managing this traffic?

\_\_\_\_\_

\_\_\_\_\_

**Space activity:** Now take a measuring tape and locate a parked bus (average-sized). Talk to its owner/driver/conductor and measure the length and breadth of the bus. Also enquire about its passenger capacity (the total number of passengers it can carry).

Length : \_\_\_\_\_ Breadth : \_\_\_\_\_

Therefore, Area = Length X Breadth = \_\_\_\_\_

Passenger capacity = \_\_\_\_\_

Now, let us find the space occupied by a bus per passenger. Divide the total area of the bus by the total number of passengers.

Space per passenger = Total Area/ Passenger capacity = \_\_\_\_\_

Now repeat this exercise for an average size car.

Length of the Car = \_\_\_\_\_ Breadth of the Car = \_\_\_\_\_

Area of the Car = \_\_\_\_\_ Passenger capacity of the car = \_\_\_\_\_

Road space occupied per passenger – Total Area of the car/passenger capacity = \_\_\_\_\_

Now, compare the road space occupied. Which occupies more road space? \_\_\_\_\_

On an average, a bus occupies two times the space occupied by a car and can carry 40 times the number of passengers. And it is not only a question of road space but also of parking. Please refer to our activity sheet on "Parking" to get more information on the same.

### Public Transport – A Greener Form of Travel

Taking public transport and leaving the car at home is one of the biggest contributions towards a green environment. Car journeys contribute a significant amount of our overall carbon footprint.

#### Quicker

Despite their tendency to get delayed at times, your journey will be quick and direct as more and more investment goes into Metro and bus routes across India.

#### Cheaper

Using public transport means no parking charges, taxes or car insurance. Plus it removes the cost of maintaining your car at a high standard.

#### No Parking

One of the most irritating things about driving a car or motorbike is the need to hunt for a parking spot upon reaching your destination. Parking space is often scarce and expensive. The need to park is eliminated while using public transport.



# 3

## Land

- More than 15,000 species of plants and 75,000 animal species have been identified in India. Do you know how many species thrive in your backyard?
- Close to 40 million people reside in forests in India and depend on them for their livelihood. And we don't even think twice before wasting paper, made from precious trees.
- Mining generated 1.8 giga tonnes of solid waste in India in 2005. 1.8 giga tonnes = 1 800 000 000 000 kilograms. We can't finish counting the number of zeros in that figure. Imagine what impact that load of waste must have had on environment.
- Did you know that the receding green cover can trigger natural disasters more frequently? No wonder devastating storms hitting Asia have intensified five-fold in last 50 years.





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Forests?



Because the last trip to Corbett National park was a fascinating experience? Yes, it was a real adventure to be out there in the woods. And because textbooks tell us that forests are important for maintaining the 'ecological balance' on planet earth...

But what does that really mean? Do forests really play any role at all in the daily life of a person who lives in Delhi or Mumbai, Bangalore or any other city?

Oh yes, forests are a crucial survival resource – for water, for air and for food. Dwindling woodlands cannot only sap the economy of a nation but also the health of its people. So let's explore the greens and find out more...

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be used by upper primary students under the Science subject while secondary school students can use them after finishing the chapters of Geography (social science) on Landscapes and Resources.

### Gobar Gyan

Human beings began to bond with forests four billion years ago, when the first two-legged homo-sapiens settled themselves around the woodlands of East Africa. Since then forests have played multiple roles to take care of our basic needs of food and water. They act as 'water tanks', 'disaster managers', 'soil conservators' and what not. Yes! All in one.

When rainwater falls on forests, the soil — held together by the roots of trees — soaks it in like a giant sponge. A large portion seeps down and recharges ground water, while the remaining feed the local rivulets and springs. The tightly interlocked roots also prevent the fertile top soil from being washed away. They absorb running water and slow down floods. Yes, disaster management 'nature style'.

There's more. Forests are our most effective weapon in combating Climate Change. The trees and plants of the forest absorb huge amounts of carbon dioxide and thus sequester carbon dioxide - acting as carbon sinks.

### Activity — 1

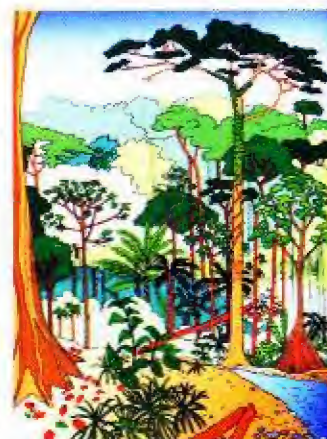
Let's find out more about the carbon sinks in the country. One acre of a fairly dense forest can sequester one metric tonne of carbon dioxide in a year. Find out the total forest cover of India in acres and find out how much carbon dioxide is being sequestered by Indian forests in a year...

Total forest cover of India in acres: \_\_\_\_\_

Total carbon dioxide sequestered: \_\_\_\_\_

Activity: Some important forest dwellers are listed below. A forest has the following important kinds of living beings staying in it (complete the list):

- |                 |                    |
|-----------------|--------------------|
| 1. <u>Birds</u> | 2. <u>Reptiles</u> |
| 3. _____        | 4. _____           |
| 5. _____        | 6. _____           |
| 7. _____        | 8. _____           |



## Gobar Gyan

Does the list mentioned above include human beings? No? Most of us forget to include ourselves. We just think about the animals and plants, which are found in the forests and forget that they are also homes to a sizable number of human populations. In India, it is estimated that over 40 million people, tribals and other communities, reside in forests and depend on it for their livelihood.

They have been portrayed as villains by some die-hard conservationists, who see them as a threat to the existence of forests. They believe that these people who live in villages in and around the forests exploit its resources. They collect forest products like fruits, herbs and flowers. They also graze their cattle in the forest land. So their solution is to throw these people out of the forests and 'fence' the forest to protect it.

But can they leave the place where they work? What will happen to your parents, if one day somebody closed down their office and told them to go work outside the city or town. Isn't this similar? The forest is literally the 'office' or place of work for the forest people. Well, frankly speaking, it's their home.

Is it practical to uproot people who have for generations been dependent on the forest? Where do we settle them? Can't we mentor them to use the forest judiciously? Can't we take their help in protecting the forest from being cut or from poachers? These questions need to be answered before we think of uprooting people from the forests.

Perhaps it's best to work with the people in the forests to protect the woodlands, because they have done so for many generations.

### Activity — 2

Next time you visit a national park or a sanctuary on an 'eco' tour, make it a point to tell the organisers to not only take you on a safari but also make you visit a village out there. Talk to the villagers and seek answers to the following questions:

How does the forest help the villagers? Do they depend on the forest for any daily needs?

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Do they get products from the forest which are of economic value and can be sold in the market?

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How do they protect the forest? Does the forest department help them?

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Are they ready to resettle somewhere outside for the protection of the forest? Or would they stay there and support the forest department?

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Does anyone hunt in the forest?

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(If you are not able to visit a village in the forest/national park – make sure you visit a village on the boundary of the national park and ask the same questions.)

### Gobar Gyan

A lot of products that we use have their origin in the forest. One important one is the broom. Although now we find brooms made of plastic in the market, but still the grass brooms are the most widespread. Many of the brooms used in India are products of what was collected by tribals from forests of Orissa, Jharkhand and Madhya Pradesh. Even Harry Potter's broom is made of forest products. Read this:

" The Nash family in Hampshire, London got a pleasant surprise some time back when they were chosen as the official broomstick suppliers for a Harry Potter film. The family, which makes the brooms out of the birch wood, which they collect from a nearby forest, revealed that the art had been passed on to them by their ancestors and that they are now expecting world wide fame".

-Read full story at <http://sify.com/peopleandplaces/fullstory.php?id=13587054>

### Activity — 3

Let's find out a few products, derived from the forest, used in our daily lives:

Product	Raw material from Forest
1. _____	_____
2. _____	_____
3. _____	_____

It might be possible that a lot of the items contain a small but nevertheless important proportion of forest products

### Activity — 4

Ok! Now we know a bit more about forests. But one doesn't really understand the importance of something until it's all gone. But we can't afford to do that in this case. In the lines given below, write about 'a world without forests'. How would it be, what would happen?

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Gobartimes

## Green Schools Network

## ACTIVITY SHEET

Why talk about  
Birds, Insects and  
Earthworms?

How much time have you spent thinking about these living beings? Probably you have seen and appreciated an odd bird or two but who thinks about insects and worms really! They are slimy, scary or both. But together, they are vital links in the food chain and play an important role in the ecosystem. They are also integral to all human cultures with a special place in our language, art, history, philosophy and religion.

As human society becomes more urbanised, we drive away terrestrial birds and distance ourselves from the world of critters. But can we live without them? Let's explore each one separately:

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be given to primary school students after completion of the Environment Education lesson on Birds and Indian Wildlife. They can be also used for art and crafts subject to sensitise students about endangered species.

**Birds:**

Watching birds can be a very exciting thing to do. Just looking at their colours and antics can be an engaging activity even if you don't know the name of the bird. You can go on bird watching tours organised by a number of clubs and groups across India. Did you know that India had nearly 1,250 species of birds (almost 14 percent of the world's species)? So what are you waiting for? Go join your neighbourhood club. Check out the following websites for more information:



[www.kolkatabirds.com](http://www.kolkatabirds.com) – it has a section on 'bird watching for beginners' – that would be just right for you. [www.indiabirdwatching.com](http://www.indiabirdwatching.com). Visit [www.delhibird.net](http://www.delhibird.net) for bird watching in Delhi. A search on the internet would give you contacts of a lot of bird-watching clubs in India.

**Gobar Gyan**

Did you know that a lot of the urban birds are now disappearing as they can no longer find appropriate food and nesting space. The average population has dwindled and some species are hard to find. Moreover, some of the smarter species of birds like crows have taken over the available space and food, making the other species vulnerable. The common household sparrow is now difficult to spot.

One tragic story is the disappearance of vultures. Scientists claim that the culprit is the drug diclofenac. Diclofenac is administered on sick cattle, some of which die. When vultures consume the carcass of such animals, the drug enters their systems, which hampers the hatching of their young ones. But fortunately this drug has now been banned.

To get more information on the issue of disappearing birds, read Gobar Times of 31 October 2005 or visit <http://www.gobartimes.org/20051031/20051031.htm>

**Activity — 1**

Go to a park nearby or just sit quietly on the roof of your house. Take a notebook along. Without making any movement or noise keep a lookout for birds on the trees and buildings nearby. The best

time to do this would be mornings or early evenings. List the birds you have seen. If you are not able to identify a bird, write a description of the same. In fact, it's fun giving a fictional name to an unknown bird.

### Bird's Name

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### Description

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If you have a good hand at drawing, try and draw the birds. Or you may also click photographs of some.

Try and do the same in your school by reaching there early one morning. Put up the names of the birds and their description on the notice board.

If you are really excited about bird-watching, spend some time locating a nest. It's not as easy as it seems. Write down the places where you found nests here. (Also, find out why the nest was placed at a particular location and list the materials used for nesting.)

### Nesting place

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### Nesting Material

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### Reason of placement

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Are all the nests identical? If not, why?

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## Activity — 2

Speak to a any senior person in your family — grandparents or parents — and ask them about any birds which were common during their times but are not to be found now. Write their names and the possible reason for their disappearance:

Name of the person interviewed: \_\_\_\_\_

### Birds name

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### Reason for disappearance

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## Gobar Gyan

Did you know that birds are covered under the Wildlife Protection Act (WPA) 1972 making it illegal to catch, keep, kill, buy/sell birds or damage their nests. All indigenous bird species are covered under this Act.

### Insects

Many insects are herbivores, or plant-eaters, which makes them primary consumers.

Abundance of primary consumers ensures supply of protein and energy for secondary consumers, known as carnivores. There are many secondary consumers, such as lizards, spiders, snakes, and toads that cannot survive without insects. Tertiary consumers eat other carnivores. For example, bears and chimpanzees eat insects as well as other animals. So if we destroy an insect we disturb the entire ecosystem.



### Activity — 3

Go to a shop and find out the pesticides and insecticides available there. Check out the components. What are some of the side effects of the chemicals used? Are they doing more harm than good?

#### Name of Pesticide

#### Components

Insect 1. \_\_\_\_\_

\_\_\_\_\_

Insect 2. \_\_\_\_\_

\_\_\_\_\_

Insect 3. \_\_\_\_\_

\_\_\_\_\_

Insect 4. \_\_\_\_\_

\_\_\_\_\_

Insect 5. \_\_\_\_\_

\_\_\_\_\_



Effects: \_\_\_\_\_

### Activity — 4

Did our grandfather, grandmother, parents etc. use pesticides or other sprays to get rid of bed bugs? Find out what they did to deal with the problem. How much trouble did it cause them? Did the bed bug cause any disease? Did it cause any allergy?

Traditional Pest Management: \_\_\_\_\_

#### Earthworms:

Earthworms are probably least liked and most useful one of the lot. They have been dubbed "nature's tiny farmers" because of their ability to help plough, aerate, hydrate and fertilise the earth and produce plant food. So next time you encounter a worm, even if its in your own house after a rainy day, take care not to squash or kill it.

### Gobar Gyan

An estimate from the Ministry of Food Processing in India says a whopping Rs. 58,000 crore worth of agriculture food items get wasted in the country every year. Ever thought of how much you contribute to that?

An easy way of reducing kitchen waste is to adopt vermicomposting. It's the process of using earthworms to turn organic waste into vermicompost – also known as vermicast or worm compost – a high quality natural fertiliser and soil conditioner. The worm compost can be used in the garden and for potted plants.



### Activity — 5

Make your own vermicompost facility! How? There are many ways to practice worm composting. Search the web, talk to people around your house or the gardener, and figure out the method that suits you the best. Write the steps you followed to prepare your worm-composting facility in the space provided on the next page:

To facilitate your work here are a few links: [www.wormdigest.org](http://www.wormdigest.org), [www.allthingsorganic.com](http://www.allthingsorganic.com), [homepage.mac.com/cityfarmer/PhotoAlbum23.html](http://homepage.mac.com/cityfarmer/PhotoAlbum23.html), [www.nyworms.com/vermicomposting.html](http://www.nyworms.com/vermicomposting.html)

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## Gobar Gyan

Charles Darwin, the famous scientist who came up with the theory of evolution, once said this about earthworms: "The plow is one of the most ancient and most valuable of man's inventions; but long before he existed, the land was in fact regularly plowed and still continues to be thus plowed by earthworms. It may be doubted whether there are any other animals which have played so important a part in the history of the world, as have these lowly organized creatures."

### Activity — 6

Make a list of the amount of kitchen waste your house generates in a week again. Only this time, use your vermicompost bin to collect whatever waste your earthworms can eat, leaving out dairy or poultry products.



**DAY**

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**Amount of Waste in Kgs**

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**Total** 

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Noticed a change in the amount of kitchen waste you generated?

# Green Schools Network

Gobar Gyan

## ACTIVITY SHEET

### Why talk about Parking?



Because the parking lot is full! There is no space left anywhere. The pavements on which you may walk to school are blocked with parked cars and because the private cars parked along the school (after it is over) create a traffic jam everyday. With over 1,000 vehicles being registered in a city like Delhi everyday, soon we would be left with no space to park our vehicles (there's already a crisis). The only option is to park these vehicles on public land, thereby encroaching on pavements, roads and parks. Excuse me ... what would the public walk on if all public spaces are gone? Is that our only problem? Let's explore!

Name .....

Class ..... Date .....

**Curriculum Connect:** Vehicular congestion is part of Science as well as Geography. These activities can be a useful home assignment for primary and secondary students. They can be clubbed with the activities on Road.

### Gobar Gyan

Most of the vehicle owners in cities park their vehicles on public land in front of their houses. Interestingly, nobody pays for it though they are using public property. The result – along with rows of houses, we also have rows of vehicles parked, which eat up on the buffer on alleys and service lanes, making them more congested. Its difficult even to play street cricket these days as there are cars and vehicles parked anywhere.

### Activity — 1

Do your parents own a vehicle – car or two-wheeler? What about your neighbour? Conduct this survey in your colony.

Where do your parents and neighbours park their car/two-wheeler?

- |   |  |
|---|--|
| <input type="checkbox"/> Inside the house                             | <input type="checkbox"/> Outside the house on public space |
| <input type="checkbox"/> Car parking on the ground floor public space | <input type="checkbox"/> Common parking in the colony      |
| <input type="checkbox"/> Others .....                                 |  |

Take a simple measuring tape and find out the area occupied by your car/two wheeler when it is parked. Just find out the length and breadth and multiply to find the area.



Area used for parking: \_\_\_\_\_ sq. m

Find out the approximate number of vehicles in your city and estimate the amount of space occupied by them.

Interview at least 10 friends in your class and ask them about the place where their parents park their vehicles:

### Type of parking

Parking on public space .....

Personal parking .....

Others .....

You can also ask your friends to measure the space occupied by their vehicles and find out the average space required by a vehicle.

### Gobar Facts:

- A typical vehicle stays parked 95 percent of the time, that is, 22.8 hours in a day.
- A typical vehicle requires reserved space at three different points:
  - i. At home: where it is to be parked for the night
  - ii. On the road: when it is on the move
  - iii. At office: for parking during office hours

And if someone else takes this reserved space, there are arguments and fights. Find out if there are any major problems regarding parking in your colony.



### Activity — 2

Talk to the President of the Resident Welfare Association of your colony or any senior person living in the locality for more than 10 years. Ask him/her the following questions:

Name of the President:

How many vehicles does he/she own?

Is the parking lot in the colony sufficient for all residents?

Are there any problems relating to parking among residents? If yes, what are the reasons for the same?

Is any parking fee charged from the residents? If yes, how much?

### Gobar Gyan

Most of our cities were never built to accommodate such a huge population of private vehicles. Experts believe that demand for parking is infinite and no amount of supply can meet it. Then what can we do about this problem? Some believe that people must be asked to prove they have space to park their vehicle in the compound of their house, before their vehicles are registered. Others believe that vehicle owners should pay the government for parking vehicles in front of their houses – it would be a disincentive towards owning a car and thus people might start using public transport. But the public transport system needs to improve (That's another story, of course!).

Experts believe that the parking fees even at commercial spaces are too low to discourage people from using cars. The worldwide trend now is to hike parking fees to deter the use of cars in cities and thereby relieve city roads of congestion, thus lowering air pollution.

### Activity — 3

Let's try and find answers from all the stakeholders:

The parking attendant: Go to a nearby parking lot and interview the parking attendant.

Name: \_\_\_\_\_

Ask him how much he charges for a car and a two-wheeler.

Car: \_\_\_\_\_ Two-Wheeler: \_\_\_\_\_

Did he ever hike the parking fee? If yes, how much? Did it work? If not, ask him what would happen if the fee is hiked?

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Is the area large enough or does his parking lot get congested at times? What time during the day?

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Your parents/neighbours: Ask your parents or your neighbours if they would be ready to pay the government for parking vehicles in front of their houses. Record their responses.

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Traffic policemen: Try and speak to a traffic policeman/woman off duty and ask him/her about his/her opinion on the issue of parking. What were his/her comments?

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### Gobar facts

What are other countries doing about the parking problem?

- Public parking fee was hiked in Bogotá, Colombia and private companies were allowed to charge as much as they wanted as parking fees. This generated additional revenue, which was dedicated to road maintenance and public transport.
- Extremely high parking fee and conscious limiting of parking space has dampened car ownership phenomenally in New York, the US.

After having interviewed so many people and collecting information, what do you think Indian cities should do to solve the problem? Don't rely on what the experts say. Write your own opinion – may be you can find a solution.

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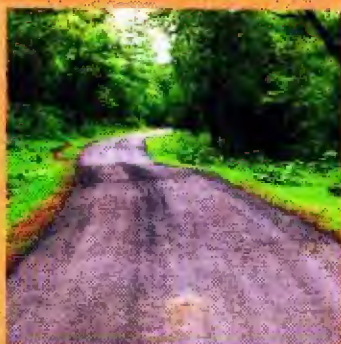
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# Green Schools Network

## ACTIVITY SHEET

### Why talk about Roads?



Because they bring the markets closer, ensuring that everyone, from a farmer to a business man can transport their wares – sell and buy with ease. They connect people to schools, jobs, hospitals, banks ... everything. A set of good roads can actually work like a magic wand, transforming a backward, poor and remote region into a buzzing action centre!

#### So should we build more and more roads?

Wait a minute! Have you also considered the environmental costs of building roads? You see, roads have some major negative impacts as well – on environment and on the local communities whose village/town they cut across.

Perhaps we need to look at more environmentally-sound roads. Unfortunately this is also 'the road less travelled' ... at least in our country.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be part of Science and Geography subjects. Secondary as well as higher secondary students would be able to do the activities efficiently. The activities on parking can be used additionally.

### Gobar Gyan

In India there are more tar roads than concrete ones. Gravel and sand are the primary raw materials used in building these roads. These are usually dug up from the banks and beds of local rivers. So, as more and more super and express highways come up, aggressive mining of stones along river banks takes place. And highly-polluting stone crushing units mushroom. In Himachal Pradesh, for instance, excessive stone and sand removal from riverbeds has resulted in rivers changing courses. This, in turn, endangers roads, bridges and agricultural lands.



To know more check the following link: <http://cities.expressindia.com/fullstory.php?newsid=242826>

### Activity — 1

Locate a road construction site nearby, where a new road is being built or an old one is being resurfaced. Talk to the person/contractor in-charge of constructing the road and find out about the raw material used.

What raw materials are being used to make the road?

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Where is the gravel and sand coming from? Is it a local crusher? Which river is it coming from? Get its address.

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If possible get to the stone crushing unit and find out if it is excessively mining the river. Talk to people around to find out if they face any problems due to the crushing.

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## Gobar Gyan

While the neighbourhood roads may have problems with procurement of raw materials, it's the highways – touted as signs of development – that need to be planned differently to ensure that we develop 'sustainably'.

Most highways are made on raised platforms (significantly higher than the general landscape). Surrounding areas are dug up to raise the height of highways, which at later stages lead to a lot of soil erosion. As if that was not enough, badly planned highways block the drainage of surface water. As they are on raised ground, they act as barriers, not allowing water to flow to the other side. This results in water logging, which in turn causes loss of crops among other things. Hence, proper drainage vents need to be given while constructing a highway and drainage patterns should be taken into account at the planning stage. Also, in hilly areas unplanned highways may lead to major land slides.

### Activity — 2

Ask your teacher to arrange a visit to a local highway near your village/city. Observe the placement of the highway in the general landscape.

Is it raised as compared to the area around?

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Do you find any water logging around the highway? Is it substantial?

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Walk along the highway for about a kilometre or two and see if proper vents have been provided for drainage of water.

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Locate the office of the National Highways Authority of India (NHAI) near your village or city and fix up a meeting with an engineer. Ask him the following question:

Is the highway made with environmental considerations, like water logging? What was done to prevent water logging?

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Ask for a copy of the Environmental Impact Assessment Report of that stretch of the highway.

## Gobar Gyan

Roads can actually disrupt the rural communities in a big way. They can cut across the agricultural land of villagers and thus disrupt their traditional routes. Now they would have to cross a road to reach their fields. This can bring a host of problems – it can be dangerous for the villagers and their cattle and can also be fatal for highway drivers. Roads can bring a lesser-identified problem – air pollution. Roads obviously mean vehicles, which are the main cause of air pollution. Settlements near highways often complain of severe levels of air and noise pollution. In fact roads can bring about a lot of socio-economic change in settlements around the highway. Let's find out more.



### "Roads disrupt?"

A super highway can lead to deforestation, erode bare slopes in mountainous terrains, triggering landslides, even change the course of rivers! My God!

### Activity — 3

Identify a highway near your town or city and interview people living near it about the changes which have occurred since it came up. You can also visit a village where a road has been constructed recently or talk to someone who hails from the village. Also try talking to your grandparents about their experiences around the time roads were constructed in their neighbourhood. They would obviously tell you about how it benefited the place, but catch the smaller details, the negative impacts such as those listed above.

What changes did the making of roads bring about in the village? Was there any disruption of usual everyday activities of the village?

### Gobar Gyan

Roads are a serious threat to biodiversity in an area, especially to animals. A road constructed near a forest with wild animals may lead to their migration, as they get scared of the noise made by moving vehicles. The road also becomes a major barrier in the movement of animals within the forests.

But the most serious problem is the fact that a large numbers of animals are killed by speeding vehicles when they cross the road. Read this recent news item:

- A tiger was found dead near the Dudhwa National park after it was knocked down by a truck passing down the state highway that runs across Uttar Pradesh's largest wildlife reserve, about 250 km from here.
- According to the park director, "Apparently the tiger was hit by a passing truck in the early hours of Friday and the body was discovered barely 20 metres from the highway, sometime later in the day."

**Source:** <http://news.in.msn.com/national/article.aspx?cp-documentid=1233540>

It's only the tiger which makes news. There are a large number of animals like the Neelgai, whose death go unreported. Thanks to the intervention of environmentalists the proposal of the Uttaranchal state government to make a highway cutting across the famous Corbett National park has been stayed.

### Activity — 4

Search on the web and in the library to find out if there are more highways being planned which would be dangerous for local flora and fauna. List at least two such projects here:

#### Project 1

Location: \_\_\_\_\_

Affected forest's/sanctuary's name: \_\_\_\_\_

Problems identified: \_\_\_\_\_

#### Project 2

Location: \_\_\_\_\_

Affected forest's/sanctuary's name: \_\_\_\_\_

Problems identified: \_\_\_\_\_



If possible, visit an existing, potentially dangerous highway, and talk to vehicle drivers and local villagers to gather more information about the issue.

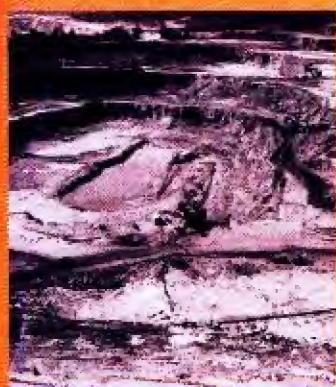
*If you are really passionate about this issue and want to explore more, read the Gobar Times' issue on roads, April 2007. Visit [www.gobartimes.org](http://www.gobartimes.org) Write to us if you had an interesting experience while doing the above activities.*

Gobar Gyan

## Green Schools Network

## ACTIVITY SHEET

## Why talk about Mining?



For a millennia, mankind has extracted minerals from the subsoil. Especially metal ores have been treasured throughout history. Did you know that the use of some metals changed human lifestyle so dramatically that whole eras such as the Iron Age were named after them? Today we depend on mining more than ever. But mining has a frightening dark side too. It contaminates rivers and lakes, destroys vast areas of forest and farmland and displaces and infects local communities and workers. In present day India, mining threatens people and environment more than ever before. Let's not pretend it does not happen and let's see what is going on in the mining areas of the country.

Name .....

Class ..... Date .....

**Curriculum Connect:** These activities can be used by secondary and higher secondary students as work sheets for the Science lesson on mineral and rocks and also as part of the Geography lessons on minerals and energy resources.

## Activity — 1

You will know most of the following items from your daily life. Did you also know that they all contain materials obtained through mining? First find out the minerals that make up these items. Refer to your Science book or the internet. Then match the minerals with the mining sites on the map.

Stainless Steel		Car battery
Glass		Lead
Iron		Frame of bicycle
Chromium		_____
Internet wire		_____
Aluminium foil		Drill bits
Processed		Diamonds
Bauxite		_____
Music tape		Electricity
Chromium		Coal
Concrete		_____
_____		Brass bell
_____		_____
Electrical Wire		Beverage can
_____		_____

## Gobar Gyan

## Mining and waste

In 2005, mining generated 1.8 Giga tonnes (1 800 000 000 000 kg) of solid waste in India alone. Can you imagine how heavy it is? It is more than three times the weight of the total world population. But how did it come to this huge an amount?

Imagine yourself treasure hunting. What would you do to lift a buried treasure chest? Maybe you would grab a shovel and dig your way down to it. This is exactly what happens in 80 percent of



India's mines. The only difference is that the treasure is not in a chest but is scattered through the rock, and it is buried deep beneath the earth's surface. All the rocks above, which have to be moved, finally end up in soaring mountains of debris.

## Gobar Gyan

### Mining and Air and Water

But why are these artificial mountains so harmful? First, they occupy lots of space and form veritable debris deserts. In dry season the wind blows out huge amounts of dust and pollutes the air. Depending on the kind of debris, this dust may be toxic. Secondly, parts of the rocks are dissolved in rainwater. This leads to the formation of acids and a solution of toxic heavy metals. This lethal cocktail flows out of the debris into the next river or lake making the latter dangerous for humans, plants and animals.

## Activity — 2

When did you have water from a steel glass last time? Find out how much mining waste was created to produce your steel glass.

Property	Calculation	Result	Unit
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First of all weigh your steel glass as precisely as possible

Weight of your steel glass	—		Gram (g)
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Your glass contains approximately 89 percent iron. How much is this in grams?

Iron contained in your glass	Weight of your steel glass x 89/100		Gram (g)
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For each gram of iron obtained from Indian mines approximately 2.6 grams of waste is produced. Calculate here how much waste the iron in your steel glass has generated.

Waste from iron production	Iron contained in your steel glass x 2.6		Gram (g)
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Stainless steel contains approximately 11 percent chromium. How much is this in grams for your glass?

Chromium contained in your glass	Weight of your steel glass x 11/100		Gram (g)
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For each gram of chromium contained in your glass 24 grams of waste has been generated. The amount is so high because chromium is obtained through open cast mining.

Waste from chromium production	Chromium contained in the glass x 24		Gram (g)
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Another important material, also obtained through mining, is required to produce stainless steel. Coal provides all the energy needed to transform the iron and chrome ores into the stainless steel.

To produce one gram of stainless steel, 4 grams of coal have to be burnt. Now calculate the amount of coal that has been burnt to produce your glass.

Coal burnt to produce your glass	Total weight of your glass x 4		Gram (g)
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For each gram of coal, 4 grams of waste is generated. See how much waste has been generated through coal combustion to produce your glass.

Waste generated through coal mining	Coal burnt to produce your glass x 4		Gram (g)
-------------------------------------	--------------------------------------	--	----------

We will now add all the mining wastes generated to produce your glass. Can you imagine how much it will be for all glasses in India?

Solid mining waste generated to produce your stainless steel glass	Waste from iron mining + Waste from chromium mining + Waste from coal mining		Gram (g)
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### Gobar Gyan:

#### Mining in forest and tribal areas – a fatal overlap

See the Activity 1 map. Have you realised that most of the mines are located in the least developed states of India? Hosting India's densest forests, these states are the nation's green lungs. And they shelter much of India's tribal population. In other words, "India's major mineral resources lie under its richest forests and the land of its poorest population." [State of India's Environment 6th Report, p 2]

Till date, 1.64 lakh hectares of forest have been diverted for mining purposes which equals to more than half of Goa's area. But what about the people who need the forests and their land to survive? It is a cruel truth that between 1950 and 1991, 26 lakh people were displaced to make way for mining projects. This is more than the present population of Nagpur, Maharashtra. Millions more breathe polluted air, drink toxic water and suffer from other consequences of mining.

### Activity — 3

Every change originates in awareness. You have now learnt a lot about the adverse impacts of mining. But how much do other people know? Find out through a survey. Compare your results in class.

You could ask the following questions.

- What do you know about mining in India?
- Where in India does mining mainly take place?
- What kinds of problems are caused by mining?
- How does mining in forest areas affect the environment?

Go through this sheet again and see what else you could ask.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

While doing this Activity you might realise how little people know about mining and its effects. Let's not leave it at that. Try to read more about mining and become an expert in this field. Make a collage about mining and display it in your school notice board or publish it in your school bulletin.





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Organic farming?



Farmers are increasingly becoming aware of the long-term economic, health and ecological benefits of switching to organic farming. Many have seen for themselves the effects of chemical farming including soil erosion, loss of soil nutrients, loss of nutrition in food, and diseases caused by the chemicals that inevitably seep into the water table. All these factors have led to an urgent demand for organic food and farming. Organic farming was not fully embraced till recently due to the widespread belief that it is low-yielding and the inputs are very expensive, producing even more expensive products. Though organic farmers have to spend a lot of time improving their land, as soil combination and positioning are the key ingredients of organic farming, it's worth investing for its ecological and social benefits.

Name .....

Class .....

Date .....

**Curriculum Connect:** Food and agriculture is part of Science, Economics and Geography subjects. These activities can be undertaken by upper primary and secondary students. These can become a project under eco-club activities.

### Gobar Gyan

Organic farming is the form of agriculture that relies on crop rotation, green manure, compost, biological pest control and mechanical cultivation to maintain soil productivity and to control pests. It also involves the exclusion or strict limitation of the use of synthetic fertilisers, synthetic pesticides, plant growth regulators, livestock feed additives and genetically modified organisms.



Organic farmers ensure the maintenance and replenishment of soil fertility. With the help of compost and other biologically induced soil amendments, they build a healthy soil structure, which increases its ability to hold water, and the plants become healthier. And healthier plants are better fortified to resist diseases and insects.





### Ecological Benefits of Organic Farming

1. Organic farming is much better for the environment, as the energy consumed is much less as compared to chemical farming.
2. It also uses less manure and avoids the use of synthetic fertilisers which otherwise pollute the soil, water and air.
3. It promotes biodiversity and a greater variety of animal-plant interaction on earth.
4. Organic farmers focus on preserving the habitats of all species and their surrounding environment, including the air and water.
5. Organic farming releases much less carbon dioxide than other farming systems.

### Activity — 1

#### 1. Grow your own organic food!

What do plants need to grow? Find out with the help of these pictures.

With the help of , , the right  and healthy  a seed has everything it needs to transform itself into a strong, healthy plant.

## 2. Best place for plants?

Maybe your school already has a garden or you have a garden at your home. If not, try to find a spot, which offers all the things plants listed above.



## 3. Healthy soil

For growing plants you need healthy soil. Remember the Activity Sheet on Earthworms? It taught us how to turn organic waste into vermicompost – a high quality fertiliser and soil conditioner. You can use the compost soil to have healthy soil in your garden.

## 4. Try creating conditions that suit them best

Whichever vegetables you choose to grow, you have to find out the conditions that suit them best. How much water does it need; does it have to be placed in shadow or in the sun? Ask for the help of somebody who has some gardening experience – maybe you know a farmer, somebody in your family or from your neighbourhood. If you don't know anybody refer to the internet:



<http://www.copper-tree.ca/garden/veggies.html> or [http://www.homeandgardensite.com/ChildrensSite/vegetable\\_garden.htm](http://www.homeandgardensite.com/ChildrensSite/vegetable_garden.htm)

**Write down the results!**

Vegetable	Needs

## 5. Where to get the seeds from?

You sometimes find seeds in shops, nurseries or you could go to a farmer and ask him for some. Make sure these seeds are not genetically modified as you want to be an organic farmer!

## 6. Care about your garden!

What does your garden need? If you have found a person who can give you tips, ask him/her what you can do to get rid of pests without using pesticides. Do they know of some organic fertilisers? Maybe you can dig up traditional, organic gardening tips! Collect and write them down.



## 6. Create your own Garden Journal!

Record the progress of your garden. It will showcase your achievements every month and highlight the changes.

- ✍ Write down every week what you did and what has changed
- 📷 Take pictures of the progress in your garden

You can evaluate your work and improve your garden with the help of the journal.

# 4

## Energy

### Non renewable Renewable

- Did you know that the energy we use today is generated from fuels that are more than 300 million years old? Yes, that's when dinosaurs existed.
- Less than 17.5 percent of Indian households use LPG as their cooking fuel. Rest use kerosene, wood or dung.
- Out of India's total energy use only about 12.5 percent is accounted for by Renewables. We can certainly do better than that, right?
- In one hour Sun supplies Earth with enough energy to cater to ALL human needs for an year! Potent, huh?





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Electricity?



Great Music, interesting movies, chilled drinks, warm water in winters – we need electricity for all these comforts.

Usage of electricity is environmentally sensible as there is virtually no harmful by-product. But the problem is that there isn't enough for everyone. Many have to go without it. The capital city of Delhi faces a power shortage of 400-600 MW every day.

How is the electricity we receive generated? Is it coal, gas or hydel? How does it get distributed? Can we do something about the power shortage? Let's explore...

Name .....

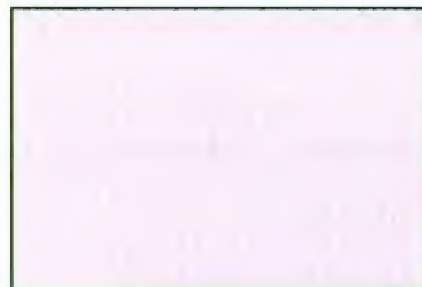
Class .....

Date .....

**Curriculum Connect:** Upper primary, secondary and higher secondary students will be able to use these activities to take stock of their electricity consumption under Science and Political Science subjects.

### Activity — 1

Let us try and find out the control room or source of electricity in your house. Ask your parents or other adults around to locate the electricity meter of the house. The meter tells you how much electricity you have consumed during a particular period. Look at the electric meter carefully. How does it look? **Draw here.** →



Does it have digital readings or do the readings change as a mechanical rim moves in the meter?

.....

Find out the name of the company which has manufactured it.

.....

Recently there was a major hue and cry about faulty meters being installed in your city. Did you know?

.....

Find out what happened. What are faulty meters? How does the electricity provider ensure that meters are not tampered with?

.....

### Gobar Gyan

Did you know that till about 40-50 years ago, electricity use in most parts of India was minimal? Ask your grandparents if they had electricity at home when they were kids? They would definitely have interesting stories to share on what a surprise it was for them.

Based on the reading of meters, your electricity bill is finalised. Many people complain about inflated bills while there are others who tamper with their meters to make them slow. To tackle the theft of electricity in Delhi, the government decided to privatise its distribution in 2002 and private players came in to give us our electricity bills. But still the problem seems to persist.

Maybe it's time you had a look at your electricity bill to see if you have an inflated bill.

## Activity — 2

Dig out the electricity bill at home. Answer the following questions:

- a) Which agency has issued the bill? Is it a public or private agency?

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- b) What is the unit used to measure electricity consumption?

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- c) What is the rate of electricity per unit? How does the rate change as the units increase?

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Get a photocopy of the bill and attach it to the activity sheet.

## Gobar Gyan

Electricity can be generated by:

- ✓ Using thermal heat produced by coal, electricity, gas etc.
- ✓ Using solar sources – solar cell etc
- ✓ Using hydel sources – dams etc
- ✓ Using wind energy (visit [http://www.gobartimes.org/20051031/gt\\_openforum2.htm](http://www.gobartimes.org/20051031/gt_openforum2.htm) for more information)

Electricity is a non polluting form of energy. It is for this reason that environmentalists are promoting its use for running trains and even automobiles. There are very few companies manufacturing automobiles using electricity, though it is cheaper to run such vehicles. The only problem is that the weight of the vehicle increases due to the batteries installed in them.

But how polluting is electricity production?

Electricity from hydel sources does not pollute the atmosphere as there are no emissions. On the other hand, thermal plants which use coal or gas emit pollutants such as fly ash and greenhouse gases like carbon dioxide. Do you know how the electricity supplied to your house is produced? Find out.

## Activity — 3

Go to your nearest electricity board office and interview an engineer. See if you can get answers to the following questions:

1. Where is the electricity generated?

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2. How is it produced?

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The image shows a sample electricity bill from the Delhi Electricity Regulatory Commission (DERC). The bill is for a domestic consumer and includes details such as the consumer's name, address, meter number, and the amount due. It also shows the electricity usage in units and the applicable rates. The bill is issued by the Delhi Electricity Distribution Company Limited (DELCO).

3. Why does load shedding happen?

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4. How does the board save electricity at a larger level? For instance, with streetlights, etc.

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Find out more about electricity. Read the October 2003 issue of Gobar Times. You can access it online at:  
[http://www.gobartimes.org/gt20031015/gt\\_covfeature.htm](http://www.gobartimes.org/gt20031015/gt_covfeature.htm)

## Gobar Gyan

Talking about conservation? It is the only alternative we have as huge parts of India still don't have any electricity and many cities have huge power crises.

We can stop wasting electricity by switching off unwanted fans, lights, televisions etc. We can also opt for technology and equipment which consumes less power without compromising on output.

One of the most talked about products in this context is CFL or Compact Fluorescent Lamp. Did you know that a 22 Watt CFL has the same brightness as a regular 100 watt bulb?

And it is said to be 75 percent more energy efficient than regular bulbs as well. Why don't you test it out?

## Activity — 4

Accompany your parents to your nearest store and ask for a CFL. Read the cover carefully. Does it claim to be more energy efficient than a regular bulb? Compare the rates of conventional bulbs and CFLs.

Normal Bulb Rs. \_\_\_\_\_

CFL Rs. \_\_\_\_\_



Which one is more expensive? Also take into account the fact that CFL bulbs are said to reduce your bill by 20 percent. Ask your parents if they would be willing to buy a CFL? Find out if anyone in your locality uses them. Did they see any difference in their electricity bill?

Prepare a list names of companies manufacturing CFLs:

- |          |          |
|----------|----------|
| 1. _____ | 2. _____ |
| 3. _____ | 4. _____ |

Are there any brands of refrigerators, air conditioners and washing machines which claim that they consume less electricity than regular appliances? What technology do they use?

Product	Technology
1. _____	_____
2. _____	_____
3. _____	_____

Find out if your school uses products that save electricity. Does it have a policy on energy conservation?

For more information on electricity conservation, visit [www.ndplonline.com](http://www.ndplonline.com)



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Bio-fuels?



A looming energy crisis is haunting the whole world, including leaders of the richest countries in the world. The panic is rising not only because of the crisis. A lot more is at stake here. Fossil fuels like oil, coal and petroleum emit carbon dioxide and other greenhouse gases into the atmosphere. And these gases are slowly destroying nature's delicately balanced climate system. No wonder everyone is now desperately looking out for alternatives.

Name .....

Class .....

Date .....

**Curriculum Connect:** Upper primary, secondary and higher secondary students will be able to undertake these activities as a Science project on use of non-conventional energy sources. The students can also use them as an extension to Political Science lessons on working of institutions.

### Activity — 1

In a city like Delhi the main source of air pollution is the growing population of vehicles. On an average, 200 cars and 150 two-wheelers get registered in Delhi everyday! Is there any system to monitor them and their emission levels? You must have heard about the Pollution Under Control Certificate (PUC). Ask your parents for the PUC of your vehicle, if they have one. Or else try to get one from a vehicle owner in your locality. Look out for the following:

a. For what pollutants is the vehicle being tested for?

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b. Which department of the government issues the certificate?

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c. What are the permissible limits for each pollutant?

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d. Go to the nearest petrol pump and locate the pollution-checking booth. Chat with the person who tests the vehicles. Look at the monitoring machine carefully. Where was it manufactured? What kinds of pollutants does it check?

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e. Find out what happens to the vehicles which fail the test.

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- g. Look out for Euro II or Bharat II stickers. What do they signify?

### Bio-fuels: Grow-your-own-fuel

Major research projects are in full swing in different parts of the world as bio-fuels capture the imagination of the world community.

### But beware of the pitfalls.

Sound like wonder oils, don't they? But if we are to go the bio-fuel way in India, we need to tread the path carefully.

#### Why?

Because land is at a premium in India. Every patch of soil is used here — either for crops or to grow fodder. Even the driest, most infertile tracts provide livelihood to communities. So on whose land will these oil-yielding seeds be grown? Biofuels are already being seen as a hugely profitable venture by the industries and they are out to grab 'wastelands' in states like Chattisgarh. This may spell doom for our farmers and shepherds who eke out a living from these seemingly useless tracts.

The challenge will be to ensure that industries don't jump into the bandwagon and bypass the local communities.

Now, let me tell you about a couple of these varieties that are being experimented with in your own country.

### Gobar Gyan

**Jatropha-liquid gold:** The seeds of a plant called *Jatropha* (*Jatropha curcas* to scientists; *ratanjyot* in Hindi) and *Pongamia* (*Pongamia pinnata*; *karanj* in Hindi) yield oils that, after processing, makes biodiesel. The system of production is simple. Oil is extracted and put through a process called transesterification (to convert it to fatty acid esters — the chemical description of biodiesel — by incubation with alcohol and alkali). This makes it a suitable blend for petroleum-derived diesel. It reduces greenhouse gas emissions by half. Scientists claim that as the conversion process improves with time, emission level will be zero!

*Jatropha* is also ideally suited to India because it is a hardy plant that can grow in abundance in dry, arid zones. In other words, land that cannot be used to grow crops can be reclaimed.



### Activity — 2

Find out if the state forest department can supply *Jatropha* saplings to your school? Which other agencies can provide you with some?

- Identify a space in your school compound where you can plant them. Remember, *Jatropha* does not need a lot of water or constant tending.

## Gobar Gyan:

### Ethanol-tasty car punch

It is produced by fermenting molasses or gurrh, a product of sugarcane. Ethanol ( $\text{CH}_3\text{CH}_2\text{OH}$ ) is an alcohol, a group of chemical compounds whose molecules contain a hydroxyl group, OH, bonded to a carbon atom. Zymase, an enzyme from yeast, changes the simple sugars into ethanol and carbon dioxide. Starches from potatoes, corn, wheat, and other plants can also be used in the production of ethanol by fermentation. However, the starches must first be broken down into simple sugars. Ethanol melts at  $-114.1^\circ\text{C}$ , boils at  $78.5^\circ\text{C}$ , and has a density of  $0.789\text{ g/mL}$  at  $20^\circ\text{C}$ . Its low freezing point comes in handy for purposes like anti-freeze in automobile radiators.

It is easily blended up to at least 10 percent with modern conventional gasoline vehicles, and much higher levels in vehicles that have been modified to accommodate it. The Indian government launched a programme to promote ethanol-blended petrol in 2003. Besides providing a source of less-polluting fuel, this is designed to help sugarcane farmers, who will get better returns from the fields.

### Activity — 3

Make Bio-fuels in your school laboratory with the help of this site: Visit [http://journeytoforever.org/biodiesel\\_make.html#start](http://journeytoforever.org/biodiesel_make.html#start)

Find out if there are any companies in India, which produce vehicles that run on fuels other than petrol, diesel and CNG? Name the companies.

Find out if the emissions from conventional fuels and bio-fuels differ.

Collect information about the various aspects of alternative fuels. Search the web and newspapers. Put up stories on your school notice board.

Find out more about bio-fuels. What is their origin? How are they made? Compare it to Petrol Diesel. How about a match between 'the Petrodiesel Bulls' and 'the Bio-fuel Knights'?

### The Burden Of Fossil Fuels: *The economics of it*

#### Petrodiesel Bulls

Hi! We are the Petrodiesel Bulls. We are great adventurers and historians, coming right from the centre of the earth. We were writing history for a million years. Our team consists of 1. Petrol 2. Diesel 3..... 4.....

5..... 6..... 7..... 8..... 9.....

10..... 11.....

Origin: \_\_\_\_\_

We are made of:

Our emissions include:

We would be helping mankind for (tick whichever is applicable)

a) Another 20-30 years b) Forever

#### Bio-fuel Knights

Hi! We are the bio-fuels.

Our team consists of 1. .... 2.....

3..... 4..... 5..... 6..... 7.....

8..... 9..... 10..... 11.....

Origin: \_\_\_\_\_

We are made of:

Our emissions include:

We would be helping mankind for (tick whichever is applicable)

a) Another 20-30 years b) Forever

### Activity — 4

Ask your mom or dad about the rate of petrol/diesel ten years ago.

Compare it with present day rates and interpret changes if any. If your parents can't give you an idea, talk to your neighbours who owned a vehicle in 2001. Or better still talk to a petrol pump owner.

Fuel	2001 (Rs/litre)	2005 (Rs/litre)	Difference
Petrol	_____	_____	_____
Diesel	_____	_____	_____

What does the data from the table tell us?

Find out the major crude oil fields in India? Consult your Geography teacher.

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Find out how much do we produce and how much do we import. Which countries do we import from? Gauge the transportation cost of crude oil from that country to India?

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Do you think bio-fuels could be a viable option for transportation? How?

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# Green Schools Network

## ACTIVITY SHEET

### Why talk about Solar Energy?



There are various forms of renewable energy, solar being just one of them. So what makes it THE renewable form of energy that the future will mostly depend upon? Earth's atmosphere, oceans and land masses absorb approximately 3,850,000 exajoules (EJ) of solar energy per year. This implies that the sun provides the earth with as much energy in an hour as the human civilisation uses every year. That is a huge potential. Let's figure out how we can tap into this renewable source available to us.

Name .....

Class ..... Date .....

**Curriculum Connect:** These activities can be part of Geography and Science lesson on minerals and energy resources of secondary and higher secondary students.

### Gobar Gyan

Solar energy is a free, renewable and clean source of energy. No worries about pollution, release of harmful gases or other by-products. However, it is 10 times costlier than conventional coal-based power with revenue generated being just one-fifth.

### Activity — 1

Discuss with your friends, Google, or just ask your teachers and find out:

Pros of solar energy	Cons of solar energy

Don't you think the advantages far outweigh the disadvantages? And those, too, are mostly technological barriers that can be overcome with advances. Discuss the impact in class.

### Gobar Gyan

To generate electricity, two types of technologies are available, Thermal and Photovoltaic.

Solar thermal electric energy generation concentrates the light from the sun to create heat. A working fluid is heated to run an engine which turns into a generator to make electricity. The working fluid that is heated could be liquid or gas, anything from water, oil, salts, air, nitrogen to helium. Different engine types include steam engines, gas turbines, etc. These engines are often 30 to 40 percent more efficient and can produce tens to hundreds of megawatts of power. Heat can be stored during the day and then converted into electricity at night. Solar thermal plants



that have storage capacities can drastically improve both the economics and the distribution of solar electricity. Heat storage is a far easier and efficient method, which is what makes solar thermal so attractive for large-scale energy production.

Photovoltaic, or PV energy conversion, on the other hand, directly converts the sun's light into electricity. Hence, solar panels are only effective during daytime as storing electricity is still not a viable option.

Solar energy can have various applications. From something as simple as drying your clothes in sunlight, to heating, cooking, power generation to lighting. The uses are vast and the list is unending.

### Activity — 2

Now rack your brains and list various applications of solar energy. Don't limit yourself to domestic use. Figure out its use in various industries, from cars to architecture. Also find out which applications use thermal and which ones use photovoltaic technology. Discuss this in class and create a representative chart and put it on the dashboard for all to see.

Domestic application	Architecture and Urban Planning	Agriculture	Water treatment	Industry X,Y,Z

Now let's roll up our sleeves and get our hands dirty. We will do something as simple as collect water using solar power, a survival tactic!

### Activity — 3

#### Solar survival – Getting water from plants

This experiment will teach you how to draw water from plants using solar energy. With just a shovel, a plastic sheet and a jar you will learn how you can get fresh water from virtually any vegetation.

#### Material you need:

- A shovel
- A clear plastic sheet
- A jar to collect water
- Any kind of plant matter
- Stones for weight



#### Procedure:

**Step 1:** Use a shovel to dig a hole in an open area which gets a lot of direct sunlight. The hole can be around 10 inches deep and 20 inches wide on each side. Now collect fresh green vegetation from your garden (weeds, leaves, mowed grass) or kitchen (vegetable peels) and place it in the hole.

**Step 2:** Clear some space in the centre of the hole, make sure the base is flat and place your jar on this patch.

**Step 3:** Cover the hole with a clear plastic sheet so you can see what happens inside. Weigh down the edges with the stones you collected so that the sheet does not flap around. Minimise the leakage of air inside.

**Step 4:** Place a stone in the middle of the sheet, directly above the centre of the jar. This will make the sheet dip a little into the jar.

#### Note down your observations:

- Report and explain your findings.
- Calculate how much water you were able to collect in one hour.
- Try the same experiment in a sand pit without any vegetation. Report your findings.

### Gobar Gyan

The Jawaharlal Nehru National Solar Mission aims at generating 20,000 MW of grid-connected solar power by 2022. This will be produced using both solar thermal and photovoltaic technologies. This is a major initiative by our government to promote ecologically sustainable growth. However, it is currently riddled with challenges of financing and research. The objective is to establish India as a global leader in solar energy, but it is a long and tough road ahead.

## Activity — 4

Read up on India's solar mission and critique it in class. Debate on two key issues — why is funding a problem and what are the challenges in forecasting the generation of solar energy from a location where a plant is proposed. Then make a solar mission for your class.

What can each of you change in your house, your school, neighbourhood or community to maximise the use of solar energy? Create a chart and track it over a period of 6 months. Then share your hard work with us at [panditji@cse.org](mailto:panditji@cse.org). We will put it up on our website so that others get inspired!

## Gobar Gyan

Wow! You've come a long way now. You have a wholesome perspective on the pros and cons, types of technology, applicability, and our country's solar mission. However, there is one more hidden aspect that you should think about. Researchers, scientists and international negotiators talk about solar being expensive, its huge space requirement and the lack of funding. But we have seen many a common man in far off rural areas with low incomes doing wonders with solar energy. We want you to research such case studies and talk about them in class. It is important to know what government, technology and money can do but you will be amazed at how societies have used solar power with their limited resources, packed with desire and common sense, to improve their livelihoods.

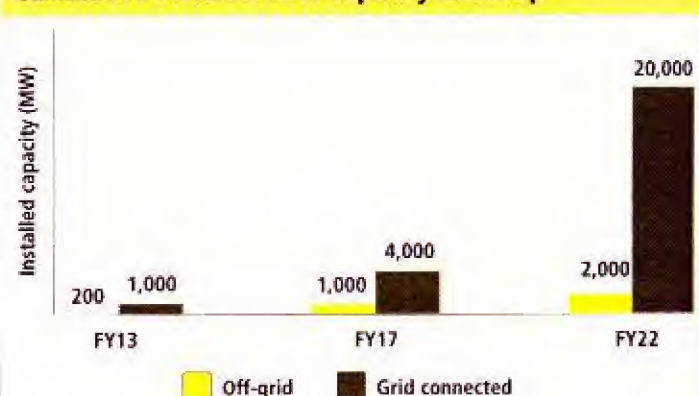
## Activity — 5

Make five groups of five students each in your class. Each group must research one case study in detail. The case study should be of villagers, societies or individuals who have made an example by using solar power to improve their livelihood.

Group I		Group II		Group III		Group IV		Group V	
Case Study	Impact	Case Study	Impact	Case Study	Impact	Case Study	Impact	Case Study	Impact

You can visit our website and see this article <http://www.gobartimes.org/20090815/20090815.asp> We have discussed many such inspiring examples with you here. But find out more examples, and send them to us. We would love to receive your case studies and share them with the whole world.

**Cumulative installed solar capacity roadmap**



Source: National solar mission document



# Green Schools Network

## ACTIVITY SHEET

### Why talk about MICRO-HYDRO POWER?



All the fossil fuels — oil, coal and natural gas — are examples of the second category "non-renewables" sources of energy. Besides being physically limited, they pose a serious threat to our health. Pollution can affect your health in many ways — both short-term and long term. Short-term effects include irritation in the eyes, nose and throat, while long-term effects can be respiratory diseases, lung cancer, heart diseases. It does not end there — it can also damage brain, nerves, liver or kidneys. Micro-hydro Power, on the other hand, is a renewable source of energy and does not harm the environment directly.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be used by secondary and higher secondary students as work sheets for Science chapters on minerals and rocks and also for Geography chapters on minerals and energy resources.

### Gobar Gyan

Climate change is a burning issue in world politics. The use of fossil fuels is the single most important cause of global warming. So what is the solution? Substituting fossil fuels with energy from renewable sources is the most logical answer to the problem of global warming. Renewable energy is drawn from an inexhaustible source like sunlight, wind, flowing water or biological growth-based fuels such as Bio-Diesel. Micro-hydro Power has flowing water as its source of energy, which is renewable because of the natural hydrological cycle. It is the most widely used form of renewable energy as it produces no waste and does not emit carbon dioxide (CO<sub>2</sub>), which is a major greenhouse gas.



### What is Micro-hydro Power?

Micro-hydro is a term used for hydroelectric power installations that typically produce up to 100 KW of power. Let's make it simpler: Micro-hydro power is the small-scale harnessing of energy from falling water. For example, harnessing enough water from a local stream to power a small factory or village. It can particularly work wonders for hilly and mountainous areas.

### Activity — 1

Find out which countries (and their states) use micro-hydro power efficiently?

Sr. No.	Name of the Country	Name of the States



### Gobar Gyan

It must have occurred to you that even big dams are constructed for harnessing energy from water. Above all, they can produce many more kilowatts of electricity. Then why do we need to build small hydro power stations when we have big dams? Do you know that the largest dams contribute to global warming? As per the Intergovernmental Panel on Climate Change, large dams could be the source of three major greenhouse gases that is, methane, carbon dioxide and nitrous oxide. The Indian government has not yet estimated the emission of global warming gases from Indian dams.

Big dams consume a lot of energy and resources during construction. The reservoir of water created by the dam leads to submergence of a lot of land

area which in many cases is forested. With the disappearance of forests the species living off it are displaced. Most importantly, people who have been living in the submergence zone are displaced and they are never adequately relocated.

Refer to activity sheet on Dams (refer page no. 40) and do **Activity — 2** again.

### Activity — 3

Now that you know the negative impacts of big dams, let's talk about micro-hydro power. Try to find out about individuals and communities in India using micro-hydro power successfully.

Name of the Village: \_\_\_\_\_ State: \_\_\_\_\_

Date of installation: \_\_\_\_\_ Capacity of the power plant: \_\_\_\_\_

No. of families supported by the power plant: \_\_\_\_\_ Installation Expense: \_\_\_\_\_

Maintenance Cost: \_\_\_\_\_

Other interesting information: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Activity — 4

Take up micro-hydro power as an assignment for the school's bulletin board. Divide the class according to the states using micro-hydro power efficiently. Each group should collect case studies and record the experiences of local communities. Write a small but comprehensive note on projects and then tag them to the map.



## Gobar Gyan

### Micro-hydro Power versus Big Dams:

- Small hydro plants only need a small amount of flow to generate electricity and therefore the stream need not be blocked by large concrete dams, which are very expensive, to build reservoirs of water. Maintenance too is not as costly as large hydro power plants. Large hydro power plant projects also require a lengthy preparation time, involving a lot of planning and testing, because there is no standard and set procedure for constructing a dam. Micro-hydro power plants, on the other hand, can be installed quickly.
- Micro-hydro power plants do not require large reservoirs and consequently there is no submergence of huge tracts of land, no loss of flora and fauna and most importantly no displacement of a large number of people.
- Any breach of the dam can also cost lives of numerous humans, trees and animals. In contrast, a micro-hydro plant is a safe option.

### Activity — 5

Does a river flow near your house/city? How will you find out its capacity to generate electricity?  
It is actually very easy. Let's try!

The flow of the river, the head (length) of the stream or the river and the gravity are major factors in generation of electricity.

Power is measured in Watts, Head in metres, Flow in litres per second, Acceleration due to gravity in metres per second per second.

Gravity is approximately 9.81 metres per second per second, that is, each second an object is falling, its speed increases by 9.81 metres per second (until it hits its terminal velocity).

Equation						
Power (Watts)	=	Head (Metres)	x	Flow (Litres)	x	Gravity (9.81)

Calculate how much electricity a micro-hydro power plants can generate given a flow of 20 litres per second with a head of 12 metres.

The main concern regarding the micro-hydro power plants is low power generation during summer months. During the summer months it is more likely that the flow of the river will be slow and therefore less power will be generated.

Do not forget to send us the case studies on successful micro-hydro power plants in different cities/states of India.



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Wind Energy?



Because it is the future! India has set ambitious targets for increasing the use of its abundant renewable resources. And wind energy appears to be the best bet, as it is clean and helps combat climate crisis. Plus, it's free and available in plenty. It is estimated that nearly 45,000 MW of electrical power can be generated if India's wind potential is fully exploited.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be undertaken by secondary and higher secondary students as part of Science lessons on alternative or non-conventional sources of energy. It can also be covered under Economics lessons on energy sectors as well as arts and crafts subject.

### Gobar Gyan

Let's revise our Science lessons on wind first. Winds are caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. In simple words, wind is the movement of air over the surface of the earth from areas of high pressure to low pressure.

Have you had fun flying kites? Have you enjoyed rotating a *firki*? Yes, they work because of wind. Wind is also a form of solar energy which can be used to generate electricity.

### Wind as a source of electricity

Do you remember the Science chapter on "Energy"?

The ability to do work is Energy. So if the *firki* rotates and the kite flies it means that wind has energy. So now the question is can we use wind energy for our day-to-day work? Of course we can!

### Activity — 1

Find out the various uses of wind energy in ancient times.

1. Early Egyptians used wind to sail ships on the Nile River.
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. Today we use wind energy to make electricity.



## Gobar Gyan

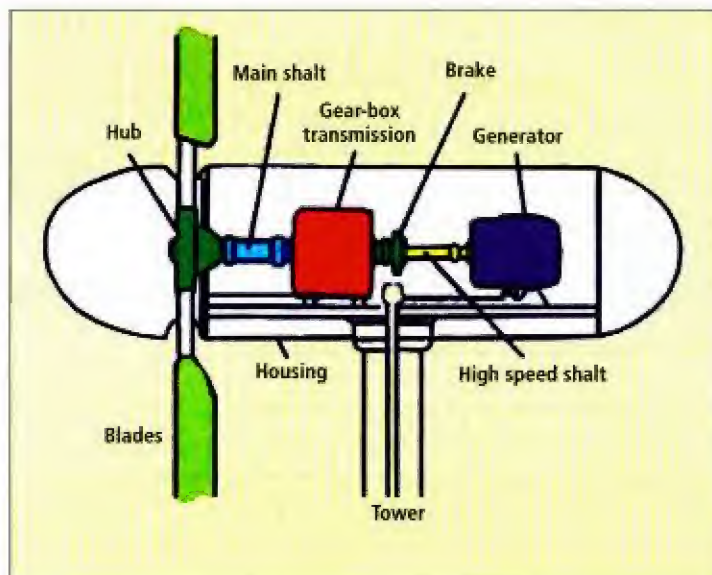
Wind power is a process wherein electricity is generated by converting mechanical power into electricity. This is done by installing wind turbines, also known as windmills, which spin because of winds and produce electricity.

Important parts of wind turbine

1. Blade
2. Low speed shaft
3. Gear Box
4. High speed shaft
5. Generator
6. Tower

How does it work?

The blowing wind pushes against the blades of the wind turbine and makes it spin. The moving blades then make the low speed shaft spin. The low speed shaft is connected to the high speed shaft by a gear box. The high speed shaft finally turns the generator to make electricity.



## Activity — 2

Let's explore wind mills/turbines. Based on the above paragraph let's trace the flow of wind. Start with the blades.

## Gobar Gyan

Wind power is one of the most promising sources of renewable energy. India ranks fifth in the world in terms of wind power with an installed capacity of 11807.00 megawatt (MW) (as on March 31, 2010)\*. Still many scientists feel that wind energy has not been explored and utilised to its full potential.

## Activity — 3

Let's now explore the pros and cons of wind energy to understand why it has not been used to its utmost potential. Search on the internet, read books, journals and newspapers to find out the drawbacks of wind energy. Discuss with your parents and teachers to find out solutions.

Area	Drawback	Solution
Installation cost		
Accessibility in Urban area		
Space for site		
Environmental Issues		

## Gobar Gyan

Wind turbines, which change the wind into electricity, need an average speed of about 14 miles per hour to generate electricity. An anemometer calculates this speed. Let's try and make an anemometer and check the wind speed. Sounds like fun, right?

## Activity — 4

Things required:

- 2 pieces of cardboard or light weight wooden sticks (round shaped)
- Scissors
- Ruler
- Stapler
- 4 plastic/paper cups



- Marker or water colour
- Bulletin board pins
- Pencil with new eraser

#### Let's start:

- Take 2 pieces of cardboard or light weight wooden sticks and make an X. Use a tape, pin or stapler to fix it. Make sure the X is sturdy enough to carry plastic/paper cups.
- Stick 4 plastic/paper cups on the four edges with tape or stapler.
- Colour one cup so that you can count the swirls easily.
- Place the X on the pencil eraser with a pin. Make sure that the X moves freely when attached to the pencil.

Now our anemometer is ready for the experiment.

To calculate the velocity at which your anemometer spins, you will have to first note the number of revolutions per minute (RPM). Next, calculate the circumference (in feet) of the circle made by the rotating paper cups. Multiply your RPM value by the circumference of the circle and you will have an approximation of the velocity at which your anemometer spins (in feet per minute)

$$\text{Velocity} = \text{RPM} \times \text{Circumference } (2 \times \pi \times r)$$

Sounds difficult? Let's break it down.

Count the rotations of the cup for 30 seconds. Multiply the number of rotations by the diameter in centimeters and divide by 265 to get the wind speed in kilometres per hour.

$$\text{Speed (Kph)} = \frac{\text{Rotation} \times \text{Diameter (cms)}}{265}$$

For example:

70 rotations in (30 seconds)

Diameter = 30

Find out the wind speed.

GobarTimes

## Green Schools Network

## ACTIVITY SHEET

## Why talk about Biomass?



Biomass is the oldest form of energy – humans have used wood for cooking and heating for thousands of years. In fact, wood was the largest energy provider in the world till the mid 1800s. In India 80 percent of the population resides in villages and they still depend heavily on biomass resources like wood and cow dung for their livelihood. The innovative ways in which villagers use cow dung is a lesson in itself. The uses range from cooking, heating, killing pests, plastering houses to fertilising farmland. And this is just the tip of the iceberg!

Name .....

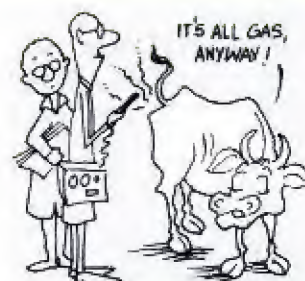
Class .....

Date .....

**Curriculum Connect:** These activities can be used by secondary and higher secondary school students. They can be used as worksheets for Science lessons on mineral and alternative sources of energy as well as Geography lessons on resources and development.

## Gobar Gyan

Biomass is any organic matter that can be used as an energy source. Everything from wood, vegetable matter, cow dung, to waste material is a biomass resource which when burnt releases energy. Fossil fuels, too, have their origin in ancient biomass but are not considered as such because they contain carbon that has been "out" of the carbon cycle for a very long time. Their combustion, therefore, disturbs the level of  $\text{CO}_2$  in the atmosphere.



Its source is the inexhaustible solar energy which is captured by plants through photosynthesis. This chemical energy of plants, when consumed, is passed on to animals and humans alike.

## Activity — 1

## Available biomass resources

Make a list of biomass resources. (Example: plants, animals, industrial waste, sewage, landfills etc.)

Example	Source

## Gobar Gyan

Biomass can be a life saver for developing nations. It is locally accessible, has low carbon emission levels over longer time-frames, is highly flexible and can be converted into heat, electricity, gas or liquid at varying commercial scales. This implies that it can meet diverse energy needs ranging from heating, cooking, illumination, refrigeration etc.



Creating and using biomass effectively is a labour-intensive process that can boost rural employment and reduce poverty. Currently, India's energy consumption pattern is 56.5 percent from commercial sources like coal and oil and the remaining 43.5 percent from non-commercial sources like wood, charcoal, agricultural residues, vegetable wastes, cow dung, urban and industrial wastes, forest etc. A report by the International Institute for Environment and Development points out that reliance on biomass fuels is set to treble from 10 to 30 percent of global energy consumption by 2050.

## Activity — 2

### How we use Biomass

Make five groups of five students each. Take different biomass resources and complete their cycle of use. Some examples have been provided for your benefit. Compare group results, discuss them in class and finally put up a chart on the notice board.

Type of waste/organic residue ( <i>crop residue, farm waste, industrial waste, forest waste, municipal solid waste, animal waste etc.</i> )	Technology used for converting waste ( <i>Combustion, Pyrolysis, gasification, alcoholic fermentation, liquefaction etc.</i> )	Result of conversion ( <i>Energy — thermal, steam, electricity. Solid fuels — charcoal, combustibles. Synthetic fuels — methanol, methane, hydrogen gas etc.</i> )	Uses ( <i>cooking, lighting, heating, water pumping, electricity generation, industrial and transport fuels etc.</i> )
Fire wood	Destructive distillation	Charcoal	Cooking fuel, smelting iron, art, medicine etc.
Cattle dung	Fermentation	Methane	Electricity generation, vehicular fuel in the form of Compressed Natural Gas etc.

That was a lot of cross-connected activity to do! Phew! Did you also get the feeling that it is an abundant renewable resource which you can capitalise on to create sustainable economies?

## Gobar Gyan

Let me tell you the story of 'Saran Renewable Energy' plant in rural Bihar. One day a young entrepreneur Vivek Gupta decided to bring electricity to his village in Saran, where he grew up without it. A biomass gasification plant with a capacity of 120 kilowatt came up in Garkha, one of the most under-developed villages in Saran, to generate electricity. As a resource Gupta chose a leafy plant called *dhencha* (a local woody plant), which thrives on waterlogged soil. So a lot of low-lying farmland that remains waterlogged throughout the year and is unsuitable for growing crops, is instead used to grow this plant. The farmers earn additional income by selling it to the plant. The plant also uses biomass resources like rice and wheat husk, plant stalks, juliflora, waste wood etc. but 85 percent of the fuel used is now *dhencha* since it has gained a lot of community support.

Since its inception, the plant has helped light up more than 200 homes, dozens of small business units, a school, and a medical centre in Garkha. The plant provides 8-10 hours of regular electricity at Rs 8-10/unit, which is 40 percent cheaper than diesel generators. Saran also releases little carbon footprint and helps save over 200 tonnes of carbon dioxide a year, which makes the project eligible to earn carbon credits. The demand for electricity in nearby villages is growing as is Vivek's business. So you see how trash from your backyard, a dose of common sense, and a brilliant idea are all you need to make your village self-sufficient.

## Activity — 3

### Case Study

Google, discuss, talk with elders and find out more success stories. Groups created for the last activity will now take up one case study each. Share your findings with your class and with us at [panditji@cseindia.org](mailto:panditji@cseindia.org). We would love to hear about more entrepreneurial ventures!

## Gobar Gyan

All biomass resources, when burnt, release carbon into the air. However, during the process of creation, they had captured an equivalent amount of carbon from the air through the process of photosynthesis. Hence, sustainable cultivation and harvesting of biomass does not increase CO<sub>2</sub> levels in the atmosphere. On the other hand, burning of fossil fuels disturbs the CO<sub>2</sub> levels in the atmosphere as it brings out additional CO<sub>2</sub> which was suppressed over millions of years. However, we need to use and convert biomass wisely. The efficiency involved largely determines how clean the process is.

## Activity — 4

### Comparison – Biomass vs. Fossil Fuels

List here the advantages and disadvantages of both the sources. Think through the societal, environmental and geological aspects.

Biomass		Fossil Fuels	
Advantages	Disadvantages	Advantages	Disadvantages



# Green Schools Network

## ACTIVITY SHEET

### Why talk about LPG?



Because LPG (Liquefied Petroleum Gas) is a key source of energy, which a large number of Indians across class lines use. LPG's toxic emissions are low, making it an effective fuel for automotive transport in the years to come. Also, the combustion or burning of LPG produces far less pollutants as compared to other fuels like petrol, diesel, coal etc. Thus, arises the need to not only promote it but also devise ways to use it efficiently. Let's first find out more about it.

Name .....

Class ..... Date .....

**Curriculum Connect:** These activities can be given to upper primary, secondary and higher secondary students to make them aware of various less polluting non-renewable sources of energy. These can be taken up by students during or after the completion of Science chapters on different sources of energy and their environmental impacts.

### Gobar Gyan

Like all fossil fuels, LPG is a non-renewable source of energy. It is extracted from crude oil and natural gas. At room temperature LPG is a gas but when it is compressed in a cylinder it becomes a liquid.

It is usually compressed and kept in metal cylinders. It can be easily condensed, packaged, stored and utilised, which makes it an ideal energy source for a wide range of applications. According to the 2001 Census of India, 17.5 percent of Indian households or 33.6 million Indian households use LPG as cooking fuel. Does your household use LPG as well?

### Activity — 1

How is LPG used in your house? Tick appropriate boxes:

☐ Heating device    ☐ Cooking    ☐ For your car/two wheeler    ☐ Others:

Find out how many kilogrammes of LPG does your home consume in a month?

☐ 14.2 kg    ☐ Less than or = 20kg    ☐ Less than or = 30kg    ☐ More

*Hint: one gas cylinder has 14.2 kilogrammes of LPG*

You can also find out the total energy consumption of your house. Just find out the consumption of LPG in your house in kgs and electricity in kilowatt hours. Go to page number 54 of the Green Schools Programme manual and find out more.

Find out more about LPG for domestic consumption at [www.ebharatgas.com](http://www.ebharatgas.com)

### Gobar Gyan

Experts believe that though much of the LPG use in India is confined to households, in times to come the usage of LPG for automobiles may change the whole scenario. Yes!! LPG can be used to run automobiles. And it is very cheap to do so. Cars like Wagon R, Chevrolet Beat, Chevrolet Spark and Maruti 800 have LPG versions already.

These days many people use domestic LPG cylinders in their vehicles, which might not be safe as they were not designed for vehicular use. Cooking cylinders are supposed to be used in the vertical position whereas the cylinders which are put to vehicular use are placed horizontally, which is dangerous. Also it is illegal to use cooking gas for automobile purposes as it is specially subsidised for domestic purposes.

## Activity — 2

Locate the nearest LPG filling station. Find out the name of the company which operates it.

☐ Bharat Petroleum    ☐ Indian Oil    ☐ Hindustan Petroleum    ☐ Some other company –Name \_\_\_\_\_

Was the filling station full of cars/ vehicles?

☐ Yes    ☐ No

How many vehicles did you see there?

☐ 0-5    ☐ 5-15    ☐ 15-25    ☐ More; Estimate \_\_\_\_\_

Is that filling station able to cater to all its customers?

☐ Yes    ☐ No    What is the reason? \_\_\_\_\_

Find out how many LPG filling stations does your city have.

☐ NIL    ☐ Below or=5    ☐ Below or = 10    ☐ More Exact No \_\_\_\_\_

Try and interview someone with an LPG vehicle. What are the advantages and disadvantages of using one?

### Advantages

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### Disadvantages

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## Gobar Gyan

The emission levels of LPG vehicles are a reason to feel happy about. The particulate matter emissions are almost 'NIL' while the CO emissions are less than petrol. According to the US Department of Energy, US propane (LPG is largely propane there) vehicles emit about one-third of the reactive organic gases petrol vehicles do. Similarly, NOX and CO emissions are also 20 and 60 percent less.

## Activity — 3

Go to the nearest pollution checking centre – the small kiosks usually found at petrol pumps. Ask the attendant there if he/she can provide you with the data of emissions from one petrol and one LPG vehicle. Compare the results and write your observations here.

Fuel	Standard CO	Measured CO	Standard HC	Measured HC
Petrol				
Diesel				

### Gobar Gyan:

Converting the existing petrol or diesel engine is an option for those who don't want to go for the LPG advantage. In fact, almost 10,000 petrol autos in Hyderabad have been converted to the LPG mode and the city plans to go in for more. But the conversion kits need to be certified, as local cheap conversion kits may not adhere to safety norms.

LPG can be stored at a lower pressure than Compressed Natural Gas (CNG). It is here that it scores over even CNG, which is another good option if you are looking for a clean fuel. Hence, the fuel tanks don't have to be as sturdy. The result is that conversion kits are cheaper and small fuel tanks can even be used in two-wheelers.

### Activity — 4

Go to your nearest petrol pump or automobile workshop and find out:

Do they supply LPG kits

- ☐ Yes ☐ If No, then where can we find one \_\_\_\_\_

Interview the workshop owner and find out how much a kit costs. Find the cost for a CNG kit as well and compare. Put the symbol  $<$  or  $>$  in the box given below by comparing the price

- ☐ LPG kit Cost Rs \_\_\_\_\_ ☐ CNG kit Cost Rs \_\_\_\_\_

What is the difference in prices between LPG and CNG?

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Conduct a survey in your neighbourhood.

After informing people about the benefits of LPG as a fuel, find out how many people would be willing to switch to LPG. Compare the number of positive and negative responses.

No. of positive responses \_\_\_\_\_

No. of negative responses \_\_\_\_\_

Note your experiences in a diary.

Ask your parents if they would consider using LPG instead of Petrol or Diesel.





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Fossil fuels?



Fossil fuels were formed many hundreds of millions of years ago, even before the time of dinosaurs and hence the name fossil fuels. The age of their formation is known as the Carboniferous Period.

"Carboniferous" gets its name from carbon, the basic element in coal and other fossil fuels. They were formed as a result of anaerobic decomposition of buried dead organisms. Humans mastered the art of producing energy by burning them. However, combustion of fossil fuels raises environmental concerns as it releases around 21.3 billion tonnes of  $\text{CO}_2$  per year and our environment is capable of absorbing only about half of that.

Since fossil fuels are formed over millions of years its supply in the world is limited. This limitation along with the fact that it is an unclean source of energy is propelling the world today to move towards renewable sources of energy.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be part of almost all subjects especially Science, Economics and Geography. It can be used after doing lessons on minerals and resource development with students of all grades.

### Activity — 1

List the differences between fossil fuels and renewable sources of energy here:

Fossil Fuels	Renewables

### Gobar Gyan

#### Types of fossil fuels

There are three major fossil fuels that you must be aware of. Coal, Oil and Natural Gas. They all provide us with varying energy levels. They are available as resources to countries based on their geological development and we have discovered ways to extract these resources and put them to varied uses.

**Coal:** Coal is a relatively more abundant fossil resource that consists mostly of carbon. Its energy content (Btu/pound) varies from 5,000 to 15,000 depending on the quality of coal. It is recovered from earth by surface or deep mining. Coal reserves are plentiful across the world but it is the most polluting of all fuels.

**Factoid:** The five largest coal users – China, USA, India, Japan and South Africa – account for 82 percent of the total global coal use.

**Oil:** Comes from crude oil, which is a mix of hydrocarbons with some oxygen, nitrogen, and sulphur impurities. One barrel of oil (42 gallons) can provide about 6 million Btu. Crude oil reserves are found in many countries but the Middle East alone accounts for 63 percent of known reserves.

High-tech oil exploration technology and practices have led to the discovery of many oil reserves.

**Factoid:** One litre of regular gasoline is the product of about 23.5 tonnes of ancient organic material deposited on the ocean floor.



**Natural gas:** Natural gas is the gas component of coal and oil formation. It is either found mixed in oil or is released from coal. In compressed form, natural gas can also be used as a transportation fuel. Energy in 6,000 cubic feet of natural gas is equivalent to one barrel of oil. Wells for natural gas are drilled in underground reservoirs of porous rocks. When it is removed from a reservoir, natural gas can either be pumped to the processing station for removal of liquid hydrocarbons, sulphur, carbon dioxide, and other components, or stored in large caverns underground until it is required. Pipelines are the main method of transporting natural gas.

## Activity — 2

### Uses of fossil fuels in our daily lives

Look at the stuff around you at home, school and in your neighborhood. Which fossil fuel are they run on or produced by? You can list both products as well as by-products. Some examples are listed below. Discuss this in class. Make an exhaustive chart and put it up on the notice board.

Product	Coal	Oil	Natural Gas
Water filter	✓		
Mountain bikes	✓		
Kerosene stoves			✓
Plastic cup		✓	

## Gobar Gyan

You have now understood the concept of fossil fuels but you need to experience their impact first hand. Let's do a small experiment and follow it up with a case study.

### Factoid

The total fossil fuel used in the year 1997 is the product of 422 years of all plant matter that grew on the entire surface and in all the oceans of the ancient earth.

## Activity — 3

### Exploring Oil Seeps

#### Procedure

- Make a mixture of sand and oil and pour it into the glass.
- Next, mix soil and water well and pour it gently over the earlier mixture.
- Take some clay, flatten it into a circle as large as the opening of the glass. Seal the soil in the glass with this piece of clay.
- Fill the glass with water.
- Sit and record your observations.

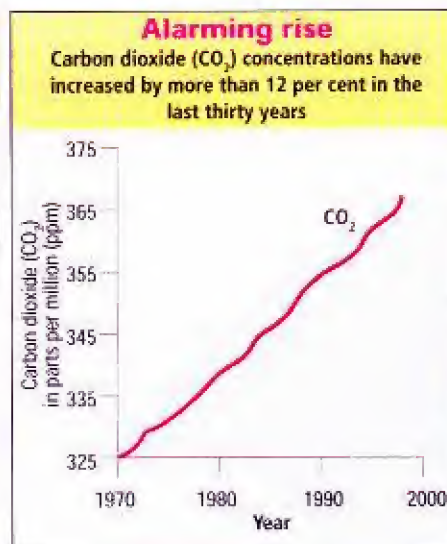
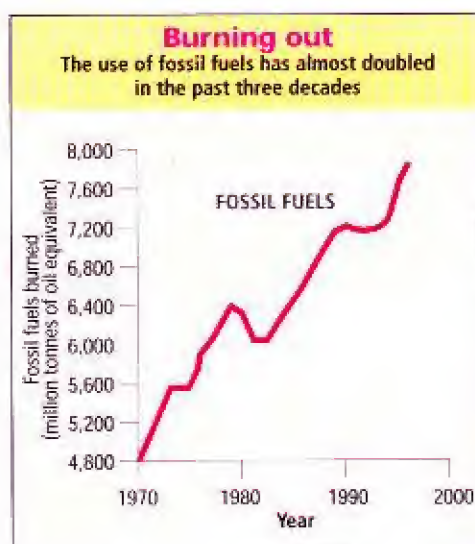
#### Report the following:

- How long does it take for the oil to seep through the layers and move to the top of the glass?
- Would the oil seep faster if you constantly agitated the glass?
- Would a taller glass with more water (more pressure) affect the rate of seepage?
- If you had used saltwater instead of normal water, what effect would that have?

## Activity — 4

### Case Study

You must have heard about the infamous British Petroleum Oil Spill and the constant minor ones reported daily in newspapers and TV channels. Research the case study in class and collectively list the negative impacts of oil spills on the surrounding ecology. Also, find out how long the impacts are predicted to last.



#### Materials:

- 1 large clear glass
- 1 small mixing bowl
- 2 ml (millilitres) of cooking oil
- 10 cm<sup>3</sup> (cubic centimeters) of sand
- 30 cm<sup>3</sup> (cubic centimeters) of soil
- 1 piece of clay
- water



# 5 Waste

- India generates over 40 million tonnes of waste every year. That's 40,000,000,000 kilogrammes of waste.
- Over 200 of the world's landfills were full by 1995. Wonder what state of mess we are in today.
- The current consumption of plastic bottles is 6,000 tonnes in India. Out of this, only 50 percent is available for recycling.
- Did you know that India generated 3.3 lakh tonnes of e-waste in 2007 and is expected to touch 60 lakh tonnes by 2012? But oooh, those new laptops are too hot to give up, right?





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Waste?



Because that's what we find everywhere and that's what most of us want to get rid of. But does the problem end once we get rid of it? Waste continues to float in our ecosystem for years and sometimes centuries.

Managing waste has emerged as a major problem in urban and even rural areas as human 'civilisation' evolves. We know all about vermicomposting and waste reuse and we make models for our school exhibition. But before doing these we need to segregate waste and engage in an analysis of waste disposal and usage, that is, waste management. Let's find out how waste is managed in our school and in our community.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be given to students of all grades. They can be converted into projects for Science and Geography subjects. It will make students realise the urgent need for reducing, reusing and recycling waste.

### Activity — 1

#### My School

Let us trace the path of waste inside your own school. Finding out the dustbin inside your classroom is not a difficult job to do. Come early to school one day and talk to the person who collects the waste from your classroom.



Name/s of the person interviewed: .....

Where is the waste from the classrooms and corridors transferred?

.....

Does the school have segregated dustbins for bio-degradable and non-biodegradable waste? If it doesn't, make a group in your class, seek an appointment with the principal and ask him/her why.

.....

Does the staff segregate the waste into different categories? If yes, what categories?

.....

Where is the waste from your school finally dumped?

.....

Who takes away the waste from the school?

.....

Ask your teacher to take you on a tour to check out how waste travels across the city and where it finally lands up. (If your teachers cannot ask your parents to take you on one.) It is one thing to read about that place and quite another to be there, isn't it? Let's be there!

Talk to a few people around. Describe the place.

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## Gobar Gyan

Segregation of waste means assorting it and putting similar things together. The primary segregation is on the basis of biodegradable and non-biodegradable products. The kinds of waste which decay biologically are biodegradable (food materials, garden waste etc) while those which do not are non-biodegradable (plastic materials, glass etc.)

Segregation is the first step towards successful waste management. No plans of vermicomposting, composting, recycle or reuse can work until you separate the materials.



## Activity — 2

### My Home

Find out how waste is managed in your house. Is it segregated? If it is not, ask your parents why. Write down their answers here and compare notes with your classmates.

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Does anyone collect waste from your house or do you go to the nearest dustbin to dispose it?

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Just have a look at your dustbin and take a guess on what percentage of waste is biodegradable.

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Visit the collection point in your locality and describe its condition here.

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Find out who takes away waste from this point and how. Is it picked up by a truck? Ask the truck driver where he heads for with it? (Ask your parents for help.)

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## Gobar Gyan

Did you know that people picking up waste at dustbins and landfills are one of the key links in the process of recycling and reuse? A whole economy thrives on waste material. You ask how? Perhaps an interaction with a ragpicker might give you insights into the same.

### Activity — 3

Look around and you would find people, even children, collecting waste materials from the dustbins near your locality. Interview one such person. In fact, you can make a team for this project. It would be much more fun that way. But do remember to inform your parents about it and take ideas from them.

What kinds of waste do they collect?



What do they do with what they collect? Where do they take it?

Any other interesting information you gathered about these people?

### Activity — 4

If your school has a vermicomposting unit, you must have already visited it. Find out the names of the worms it uses. What are their scientific names?

What kind of waste can the unit compost?

If your school does not have a vermicomposting or composting unit, ask your teacher to arrange for your class to visit one. Consult page number 73 of the Green Schools Programme Manual while making your own vermicomposting unit.

## Gobar Gyan

Waste is anything that is no longer required. It is trash, garbage, rubbish, or junk. It is generated in various forms. Currently, India generates over 40 million tonnes of waste every year. Waste generation ranges from 200 gms to 500 gms per capita per day in cities ranging from one lakh to over 50 lakh population. With more and more people coming to stay in towns and cities, the volume is increasing everyday.

**Did you know?**

- Five out of six used glass bottles are thrown straight into the dustbin!
- Recycling one glass bottle saves enough energy to light a 15-watt energy efficient bulb (equivalent to 100-watt normal bulb) for 24 hours!
- The garbage in a landfill stays for about 30 years.
- By 1995 over 200 of the world's landfills were full.
- Each person throws away approximately four pounds of garbage every day.

**Activity — 5****Organising a Yard Sale**

When you clean your room/ house you realise you have things you don't need or don't want to use anymore. Sometimes you even realise that you have no space to keep these things. So you plan to throw them away. But have you ever realised that there might be people who might want to use the stuff you don't need anymore?

So instead of throwing them away, why not have a yard sale?

Follow these simple steps:

Collect all the stuff you or your family don't need anymore

- Fix cheap prices on them.
- Invite people personally – tell them you will be having a yard sale on Sunday (since weekdays might not be convenient for people who work).
- If you are having the sale in school, announce it over the school intercom or ask your teacher to tell their students personally. This way you would also encourage other people to sell their things instead of throwing them away!
- Have one such yard sale every month.
- Calculate how much you earn every month.



Months	No. of items sold	Amount Earned (Rs.)
First Month		
Second Month		
Third Month		
Fourth Month		

**Activity — 6****Making Paper Mache**

Often when you proceed to another standard (say, from 4th to 5th) you want to throw away your old books which have your notes. Instead of throwing them away why not make Paper Mache objects out of them and decorate your rooms, classes etc.

First, let's make the paste:

Paper Mache paste is a liquid adhesive usually made of flour and water. It can also be used for decoupage, collage, and book binding.

- Simply add  $\frac{3}{4}$  cups of flour to  $\frac{1}{4}$  cup of water and mix it well until the mixture is smooth and creamy.
- To make the paste last longer, stir it well.

If you live in an area with high humidity, add a few tablespoons of salt to prevent moulding. If you don't like its smell you can add a few pieces of cinnamon!

Now let's find out a bit about Paper Mache forms. The form is the base of your paper mache project. You can use balloons, cardboard boxes, or any other material with an interesting shape.

Things you need: Decorations, used paper about 1 inch wide and 6 inches long, poster paints and brushes.

- Working with one strip of paper at a time, dip the paper into the glue and get it well saturated it on both sides. Remove the excess glue with your fingers and place the strip on your form and smoothen it. Do this gently so as to not tear the paper.
- Keep working, adding strips to the form, slightly overlapping them as you go. Let the glue dry for at least 24 hours before you apply the next layer.
- Keep at it until you have the desired thickness.
- Once you've finished the layering and the glue is completely dry, paint your figure with the poster paint and brushes. Wait for the paint to dry and then add decorative touches with tissue papers, beads, glitter etc.



For more information visit: [familycrafts.about.com](http://familycrafts.about.com)

Hey guys still have excess waste? Why not try the following?

- Donate some of your unwanted stuff to charity.
- Why not watch Art Attack on Disney channel to learn how to make some more interesting objects/toys out of waste.
- You can also borrow some things if you only need them for a short period of time.



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Paper?



A single sheet of paper may look insignificant but the cumulated use of thousands of such sheets each day can have a huge impact on the environment. Paper contains many harmful chemicals. When it is thrown away, these chemicals enter our food pyramid.

It also takes a considerable amount of energy to produce paper. Hence, reducing paper use helps alleviate climate change. Cutting down forests affects the soil, water and local ecosystem and directly affects the earth's climate. Trees are the largest 'CO<sub>2</sub> sinks', that is, they absorb a lot of carbon dioxide.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be given to primary, upper primary and secondary class students to do as part of eco-club activities and to lead a campaign on recycle, reuse and reduce. Students can also do them under arts and crafts subjects.

### Gobar Gyan

There is a lot of talk these days about reusing and recycling paper, but what we don't realise is that **REDUCING** our consumption of paper is the best way to save it. Even with the presence of efficient recycling programmes, huge amount of paper still end up in landfills. And remember, it is not only the manufacturing of fresh paper that results in the depletion of forest cover. Each round of recycling leads to a loss of fibers which translates into loss of more trees. Finally, once paper has been used, disposing it also becomes a huge problem and adds to the growing waste pile.



### Activity — 1

#### Is your school 'Paper Efficient'?

Switching to recycled paper is definitely the way to go. According to experts, 40 instances of recycled copy paper can save more than seven trees, **2,100** gallons of water, **1,230** kilowatt-hours of electricity and prevent **18** pounds of air pollution.

#### Calculate the impact of recycling on your school

- Ask your school administration how much paper is consumed daily
- Calculate its weight in pounds or tonnes
- Go to the Environmental Defense Fund's online **Paper Calculator** at <http://www.edf.org/papercalculator/> (compare individual papers and paper groups)
- Enter the weight and type of paper your school uses and you can determine the amount of wood, energy, water, solid waste and greenhouse gas emissions you will prevent by switching to recycled paper

What does your school's paper efficiency tell you?

.....

Can it be improved? .....

(Improving Paper Efficiency means accomplishing the **same task** with **less amount of paper** used.)

## Activity — 2

### Improve your school's paper efficiency:

How do you start this process? **Conduct your own mini-audit!**

- A survey of the paper use patterns in your school is an important indicator of the mindsets of the students, staff and teachers. Interview at least four people about their paper usage. These should include:
  - one teacher
  - one staff member from the administration office
  - one junior student
  - one senior student
- We have provided basic guidelines but don't hesitate to improvise and come up with your own unique questions!

**Approximately, how much paper do you consume in a day?** \_\_\_\_\_

#### ■ Out of this, how much is

- Fresh Paper? \_\_\_\_\_
- Recycled Paper? \_\_\_\_\_
- Reused Paper? \_\_\_\_\_

- On a scale of 1 to 5, assign a number to each of the following activities — 5 means 'I use the most amount of paper for this activity' and 1 means 'I use the least amount of paper for this activity'.

- Printing
- Photocopying
- Writing (work related)
- Writing (personal)
- Miscellaneous uses: (wrapping, envelopes etc.)

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

- After using the paper, how do you dispose it?

- I recycle all the paper I use ☐
- I recycle half of it and throw away the other half ☐
- I try to maximise reuse ☐
- I simply throw it away after using it once ☐

Do the answers of your four interviewees match?

\_\_\_\_\_

\_\_\_\_\_

Who has the best 'paper-practice'?

\_\_\_\_\_

\_\_\_\_\_

Why? \_\_\_\_\_

\_\_\_\_\_



## Activity — 3

### Recycle your own paper

Separate paper into three groups: white office paper, newspaper, and mixed-colour paper. Be sure to remove wrappers, plastic stickers, rubber bands – anything that is not paper.

**1. Tear It Up:** Tear paper into small pieces.

**2. Blending:** Place your paper pieces in a blender until the blender is about half full. Fill the blender (about  $\frac{3}{4}$  full) with warm water. Blend the paper for about 45 seconds. Does the pulp look smooth and well blended? If not, continue blending.

**3. Make Your Mould:** Make your homemade mould with the help of a window screen and an old picture frame. Stretch the window screen over the picture frame and staple or tack it down securely. The screen should be as tight as possible.

**4. Mix It Up:** Fill a plastic tub with water until it is about half full. Add three loads of pulp and stir it.

**5. Submerge Your Mould:** Dip your mould into the pulp and then level it out while it is submerged. Ensure that the pulp on top of the screen looks even. Slowly take the mould out of the water.

**6. Squeeze Extra Water Out:** Hold the mould with one hand and cover the wet pulp completely with a felt. Flip the felt, pulp and mould over so that the felt is at the bottom and the mould is on top. Use a sponge to press out as much water from the pulp as possible.

**7. Flat Pulp:** Hold the felt flat and slowly lift the edge of the mould. The wet sheet of paper should stay on the felt.

**8. Repeat:** Repeat the steps above until you run out of pulp. Stack the fabric squares on a cookie sheet. Press out any remaining water using another cookie sheet.

**9. Finish Up:** After you press the excess water out, separate the sheets of paper carefully. Lay each piece (still stuck to the felt) on sheets of newspaper. Wait for them to dry and peel off the felt.

***Congratulations! You've recycled your very first batch of paper! Not too difficult, right?***

Apart from the loss of trees, paper making has other adverse impacts as well. A variety of harmful emissions are generated when paper is processed – pulping and bleaching are 'Carbon Intensive' activities. In fact, the paper industry is the third largest source of Carbon (thus contributing to global warming) in the world!

On a slightly larger scale, recycling one tonne of paper saves 7,000 gallons of water, 380 gallons of oil and enough electricity to power an average house for six months.





# Green Schools Network

## ACTIVITY SHEET

### Why talk about Plastics?



Plastic is non-biodegradable and releases harmful dioxins in the air. Studies reveal that people who work in plastic industries are at a higher risk of cancer and other diseases. Discarded plastic is an urban nightmare because it doesn't rot and turn into compost. Plastic bags when discarded in fields decrease the productivity of arable land. The most dangerous feature of plastic is its toxicity with black coloured polythene bags being the worst offenders. Coloured plastic bags contain harmful toxic metals like chromium and copper, which can cause allergies. They block drains and sometimes this leads to floods as well. Have you realised that the annual Mumbai floods are mostly due to clogged drains?

Name .....

Class ..... Date .....

**Curriculum Connect:** These activities can be completed by upper primary and secondary class students under Science and Geography subjects. They can help students to plan and organise observance of the World No Plastic Day (June 8).

### Gobar Gyan

Plastic bags are the primary cause of environmental breakdown. It impacts plants and animal life in both the land and the sea. And while the statistics are incomplete, some conservationists estimate that at least 100,000 mammals and birds die from them each year even as more plastic bags are produced and consumed around the world. The exact number of fish killed by them is unknown, but they are sure to be in millions! Plastic bags of less than 25 microns are a greater menace. They cannot be recycled but they have a shorter life span and hence are disposed off quickly!



### Activity — 1

It is true that plastics are a major part of our daily life. Can we think of a day without plastics? Well if we are determined we can do without them. Let's start with a small survey in your school.

(A) Find out whether your school is a non-polybag zone.

.....

(i) If your answer is 'Yes'

Find out how many students and school staff members actually contribute to this initiative?

- ☐ Student
- ☐ Teaching Staff
- ☐ Non-teaching staff
- ☐ Visitor

Write in detail how you are contributing to this initiative.

.....

(ii) If your answer is 'No'

Share the idea with your eco-club members. Then consult to your teachers and principal about making your school a "non-ploybag zone".

Eco-club members' opinion: .....

.....

- (B) Start an awareness campaign in your school with the management's permission. Make posters, charts and sign boards for the campaign so that everyone makes an effort to stop using plastic bags. Request your school principal to announce in the assembly that your campus is a non-polybag zone.

## Activity — 2

### Plastic Audit

We usually don't carry our own bags for shopping since plastics are an easy accessory. Ultimately each plastic we take from the shopkeeper adds to the ever growing pile of grocery bags. To reduce the use of plastic bags we first need to know how many we use in a day, how many times do we reuse plastic bags and so on. What better way to find out than doing a plastic audit at home?



- (A) Count the number of plastic bags at home. \_\_\_\_\_
- (B) How many plastic bags are being reused? \_\_\_\_\_
- (C) How many plastic bags are just lying about? \_\_\_\_\_
- (D) What do you do with the bags after you have used them? \_\_\_\_\_
- (1) Send them for recycling \_\_\_\_\_ if yes, how many \_\_\_\_\_
- (2) Reuse them \_\_\_\_\_ if yes, how many times \_\_\_\_\_
- (3) Throw them away \_\_\_\_\_ if yes, where do you throw them \_\_\_\_\_
- (E) How many family members use plastic bags regularly? \_\_\_\_\_
- (F) In a week, how many plastic bags does your family use? \_\_\_\_\_
- a. Acquire \_\_\_\_\_
- b. Reuse \_\_\_\_\_
- c. Throw away \_\_\_\_\_

You may wish to extend this survey to your neighbourhood and find out the quantum of plastic used by the Society. Find out how many people take their own bags to the grocery store and how many accept fresh plastic bags every time. Share the result of the survey in the Residence Welfare Association/Society meetings. Also interview the grocery store owner and ask him the number of plastic bags he distributes in a day.



## Activity — 3

During the eco-club meeting, discuss with members about the possible alternatives to plastic bags. Write them down.

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When you buy vegetables or clothes, plastic bags are given away free of cost. Hence, it is now important to calculate the cost of alternative bags, which can replace plastic. Also discuss if these alternative bags can be made available at a cheaper price and whether they can be made at home.

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Discuss the harmful effects of plastic bags in your class. In what way can your class help stop the usage of Plastic Bags?

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Try your hand at stitching up a cloth bag yourself: [www.gobartimes.org/20100815/gobar\\_scope.asp](http://www.gobartimes.org/20100815/gobar_scope.asp)



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Packaging?



Remember the last time you packed a gift for your best friend's birthday? Well, wrapping up or 'packaging' comes naturally to human beings. Not only to make the gift look pretty, but also to protect it from breaking, tearing or getting dirty.

In ancient times leaves and cloth were the common packaging material. But now we have a wide range of 'packaging materials'. What are they? Also what happens to the package once we have used what was inside it? It is of no use to us. What happens to the large amount of packaging material generated by people all over the world? The answer is nowhere as attractive as the glittering materials. Let's find out what happens.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be taken up by upper primary and secondary class students under Science and Economics subjects. These will help students to understand the adverse effects of consumerism on environment.

### Activity — 1

It was Rahul's birthday party and he had got all the right things in place to keep his friends happy – packs of the latest crispy chips and munchies, biscuits, toffees, juices, etc. Obviously he was loaded with presents from everyone. Opening them was a lot of fun. He got a new wristwatch, a few games, a mobile phone, assorted Swiss chocolates and lots more. Next day, he woke up to a rather annoyed Mom. "Rahul! Clean up all the wrappers and boxes you left lying about." Lazy as usual, Rahul moved on to clean up the mess he had created. What are the things he would have to pick up? Feel free to add to the list of gifts.



#### List of Gifts

#### Packaging material

Wrist Watch

The plastic case of the watch and its cardboard box

Swiss Chocolates

\_\_\_\_\_

Mobile phone

\_\_\_\_\_

Games

\_\_\_\_\_

So, finally the room was cleared of the mess and Rahul was about to dump everything in the dustbin. But it was full! Guess, with what?

\_\_\_\_\_  
\_\_\_\_\_

What do you think would be the story of the remains of the cake after it is put in the dustbin? Let your imagination run wild. Do you think this story would be similar to that of an Uncle Chips' packet?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Keep a watch on the dustbin in your house. Just find out how much of it is packaging material?

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Unfortunately, packaging also leads to serious environmental problems. Waste created from packaging materials like plastic and styrofoam takes a long time to decompose. We may actually be heading for a world full of junk. Maybe it's time to look back.

What are the different materials used in packaging of food and other materials?

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Talk to your parents and find out how various items like snacks, tea and sweets were packed when they were young. Were their games packaged in paper or cardboard? Let's talk about their school days.

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What do you think of your parents' responses? Maybe their tomato sauce came in a glass bottle and now you buy sauce in a plastic bottle. The plastic bottle is lighter and takes up less room in the dustbin. But a glass bottle can be recycled and reused for a much longer time than the plastic one.

**All right! We know that you have done a campaign on banning polythene.  
But wait! Let's do a bit of research.**

## Activity — 2

Interview your local grocer: Ask him why he uses plastic bags (if he does) instead of paper ones? Find out the cost of one plastic bag. Compare it to that of a paper bag. Interview a few people in your locality. Why do/don't they use their own bags to go shopping? Find out why Lalu Prasad Yadav made terracotta cups mandatory on railway platforms when he was the Union Railway Minister. Interview a *chaiwala* on a platform and find out what he feels about the issue. Jot down your findings here. And hey, don't forget to write down what you think – because you are also a user, right?

### Plastic/New packaging material

Advantages:

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Price of one unit of polythene bag:

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### Paper/Terracotta/ Traditional packaging

Disadvantages:

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Price of one unit of paper bag:

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**Keeping the above points in mind, how would you convince the local grocer or your friend to stop using plastic bags? How difficult is it to make people follow the ban on plastic bags?**

Log on to [http://news.bbc.co.uk/1/hi/world/s/w\\_asia/107905.stm](http://news.bbc.co.uk/1/hi/world/s/w_asia/107905.stm) for more information.

### Activity — 3

There are some companies that produce biodegradable plastic bags, food containers, and medical devices. Find out more. Some people go shopping with their own bags. Do you really need a bag to carry those chips home? If customers mention they don't need bags, shop owners will have an easier time eliminating them.

Take a look around your city/village/town. Most places are dirty because of a littering of packaging material. Did you know that the routes leading to the Mt. Everest summit have become huge dump yards? Enormous amounts of packaging material have been left there by generations of trekkers. Empty tins, batteries, ropes, used oxygen cylinders, over 16 metric tonnes of plastic, broken ladders and even medicine bottles are said to have been dumped since 1952, when the first attempt was made to reach the peak. Efforts are now being made to clean up the mess.



### The 3 'R's

You must have read about the three 'R's when you explored those environment textbooks. Want to take a look at them once again? Think of three things you use personally and draw a plan here on how you can go about applying those three important Rs.

	Reduce	Reuse	Recycle
What?	1. _____	1. _____	1. _____
	2. _____	2. _____	2. _____
	3. _____	3. _____	3. _____
How?	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

There are a few companies that promote and sometimes use one these Rs for their products. You can find out about them by taking a careful look at the symbols printed on their packaging.



This symbol means that the packaging material is recyclable.



This symbol — almost similar to the one above — has a different meaning. Find out.



# Green Schools Network

## ACTIVITY SHEET

### Why talk about e-waste?



These days it's often cheaper and more convenient to buy a new PC than to upgrade an old one. But what happens to those old computers once they've been abandoned for newer models?

Discarded electronics products, also known as e-waste, often end up in landfills or incinerators instead of being recycled. And that means toxic substances like lead, cadmium and mercury that are commonly used in these products can contaminate land, water and air.

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be completed by the upper primary and secondary students as part of the "Waste Management" chapter under Science and Economics subjects. The students can share the results as part of a campaign.

### Gobar Gyan

Electronic waste or e-waste is the term used to describe old, obsolete or discarded electronic appliances. It includes computers, consumer electronics and fridges which have been disposed off by their original users.

While there is no generally accepted definition of e-waste, often it is associated with relatively expensive and essentially durable products used for data processing, telecommunications or entertainment in private households and businesses. But the ever-increasing digitisation of products blurs this distinction. All electrical appliances including kettles, boilers and ovens do or will soon contain electronic circuits and ultimately end up as e-waste.

**Examples of e-waste include:**  
Computers, LCD/CRT screens, cooling appliances and mobile phones containing precious metals, flame retarded plastics CFC foams and other substances.

"E-waste" contains both valuable and harmful materials which require special handling and recycling methods.

### Activity — 1

Make a list of all the appliances you use that could end up as electronic waste:


### What should I do with my electronic discards?

The mantra of "Reduce, Reuse, Recycle" applies here. Reduce your generation of e-waste through smart procurement and good maintenance. Reuse still functioning electronic equipment by donating or selling it to someone who can use it. Recycle those components that cannot be repaired.

**Find out:** What happens to those items after you and your family are done using them? Are they disposed off in the trash? Do you take them to a recycling plant? Do you sell them? Do you give them to a kabadiwala?

## Gobar Gyan

In India, e-waste is mostly generated in large cities like Delhi, Mumbai and Bengaluru. In these cities a complex e-waste handling infrastructure is developing, mainly based on a long tradition of waste recycling. This is mainly operated by an entrepreneurial informal sector. Rag pickers and waste dealers found it easy to adapt to the new waste stream, resulting in a large number of new businesses focusing on the re-use of components or extraction of secondary raw materials. So far, the e-waste recycling system is purely market driven.

Some of the recycling processes are extremely harmful to the workers' health and the environment. In 2004, a study was conducted on the open burning of printed wiring boards which showed an alarming concentration of dioxins in the surrounding areas. When the workers and local residents inhale these toxins or consume the crops grown in the surrounding areas they risk cancer.



*Harmful techniques like burning wires are a common practice in the informal recycling sectors in big cities in India.*

**Did you know? India generated 3.3 lakh tonnes of e-waste in 2007 and is expected to touch 60 lakh tonnes by 2012.**

India has already initiated a plan to control e-waste and some big companies in the country have started taking action on this front as well.

**ELCIA (Electronics City Association) in Bengaluru now operates a collection centre for all e-waste generated in the Electronics City region. Companies are encouraged to give all their e-waste including tube lights and CFLs to the collection point. In 2008, 16 companies collectively handed over 21 tonnes of e-waste to the collection point. These companies include Infosys, Wipro, Timken and others. The waste collected is then handed over to E-Parisaraa, an authorised e-waste recycler.**

**E-WaRDD, a Bengaluru-based association of e-waste recyclers, was upgraded from the informal sector in 2008. Its first corporate client was Titan Industries, a leading watchmaker in India. Every year Titan has an exchange programme whereby old watches are exchanged for new purchases under a special discount scheme. In 2007, between 6,00,000 and 7,00,000 old watches were collected under this scheme, most of which finally ended up in a landfill. Titan has partnered with Saahas, a development organisation which facilitates safe e-waste recycling. The watches collected under this programme will be finally given to E-WaRDD for dismantling and retrieval of components. The toxic content will be stored for disposal in a hazardous waste landfill.**

**Initial e-waste situation in India:** The e-waste from corporate consumers and households enters a city-specific informal e-waste recycling system. The collection and allocation of e-waste is done by middlemen, scrap dealers and rag pickers, also known as "kabadiwalas". The informal recycling system includes dismantling and sorting as well as harmful processes such as burning and leaching to extract metals from electronic equipment.



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Bottles?



When was the last time you had a bottled drink? Yesterday? Or perhaps the week before? Bottles are an important part of our lives, beginning almost at birth – a baby drinks from milk bottles. A chilled bottle of soft drink is available at every street corner. But have you thought about what happens to a soft drink bottle when it has quenched our thirst?

Plastic water bottles have invaded the market in India as a replacement for conventional glass bottles. The current consumption of plastic bottles is 6,000 tonnes, out of which only around 50 percent is available for recycling. So what happens to the glass bottles that are junked everyday? Is there room on our planet for so much waste that does not biodegrade?

Name .....

Class .....

Date .....

**Curriculum Connect:** These activities can be given to students from all the grades. They can be taken up as a project for the Science lesson on garbage. It can also be clubbed with activities on plastics.

### Gobar Gyan

The cry of the kabadiwala or raddiwala as he rides by slowly on his cycle is a familiar one. The raddiwalas – collectors of household waste – encourage people to sell them their recyclable waste, bottles, paper cloth etc. While they make a living collecting our waste, they also, perhaps unwittingly, make the most crucial contribution to the cycle of waste collection and recycling in the country.



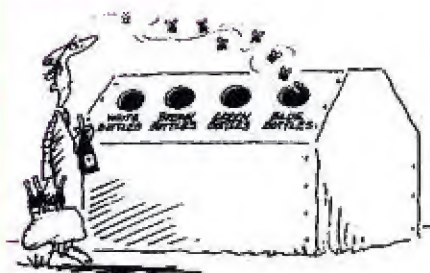
Let us do what we can to reduce bottle waste in our homes.

### Activity — 1

Make a list of all the different uses to which bottles are put to in your everyday life. Specify as best as you can, how many of each you are using right now in your home. Some examples have been given to help you along.

Uses of bottles	Plastic/glass	Number in use
Pickles and jams	_____	_____
Water storage	_____	_____
Medicine syrups	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
TOTAL NO. OF BOTTLES		_____

### Gobar Gyan:



Water bottles are usually made of polyethylene terephthalate (PET), which is derived from crude oil. Approximately 2.7 million tonnes of plastic are used to bottle water each year. Though PET is made for recycling, nine out of 10 such bottles end up in landfills – in the United States this amounts to roughly 30 million a day – where they can take up to 1,000 years to biodegrade.

It is not known how long glass takes to break down. Glass made in the Middle East over 3,000 years ago can still be found today. Recycling reduces the amount of waste glass that is land filled.

Find out: What happens to all the empty bottles in your home? Can you suggest ways to re-use them?

## Gobar Gyan

Recent studies have shown that plastic bottles release a harmful chemical into the water. It is advisable to use glass bottles to store water at home. In 2003, the recycling of glass saved enough energy to launch ten space shuttle missions!

### Some uses for empty bottles:

- Store seeds inside the bottles and label them accordingly. Seeds that need to be kept cold can easily be placed inside the fridge in these bottles.
- Glue several bottles next to each other and use the glued collection on your desk as a storage system for all your tiny things: rubber bands, paper clips, hair pins, needles, nails, bolts, screws, matches, etc. Or just place some fresh flowers inside them to brighten up your room.
- Donate your empty bottles to your local vet, animal shelters or free dispensaries. They can be reused for dispensing syrups.

Can you think of any other ways to use empty bottles? Use your imagination!

## Gobar Gyan

Recycling reduces the demand for raw materials. Though there is no shortage they do have to be quarried from our landscape and so there are environmental advantages to recovering and recycling glass. For every tonne of recycled glass used, 1.2 tonnes of raw materials are preserved.

## Activity — 2

Get together with your friends and organise a bottle collection drive in your school or your locality. Put up posters informing your friends and neighbours of the dangers of using plastic bottles and the ways in which bottles can be reused and recycled. Donate bottles to a recycling plant.



### Funky Facts

Glass can be recycled indefinitely as part of a simple process, as its structure does not deteriorate when reprocessed. In the case of bottles and jars, up to 80 percent of the total mixture can be made from reclaimed scrap glass.

Recycling two bottles saves enough energy to boil water for five cups of tea

**Remember that you could always send your empty glass bottles back to the dealer for refilling.**



# Green Schools Network

## ACTIVITY SHEET

### Why talk about Kabadiwala?



Because a kabadi, that is, waste wala – the man who comes to our house to pick up the month's newspaper collection and other things – isn't merely a service provider like your washerman. He is probably the biggest environmental crusader on the street (although he may or may not be aware of it).

Kabadiwalas in most parts of India pick up waste from individual households and forward them to larger junk dealers, who in turn supply this waste to be recycled. As it is mostly paper, imagine the number of trees a kabadiwala must have saved in his lifetime. Isn't that reason enough to have a chat with him?

Name .....

Class .....

Date .....

**Curriculum Connect:** Upper primary and secondary class students will be able to take up these activities efficiently. They can be taken up under Civics and Economic subjects to make students understand the contribution of individuals in proper waste management.

### Gobar Gyan:

Kabadiwalas are today putting tonnes of waste material on to the recycling trail and saving our municipalities a lot of work. Unfortunately, the waste recycling and collection services in India is huge but their contribution though remarkable is not adequate.

### Activity — 1

Be an investigative eco-journalist! The next time a kabadiwala comes to your house to collect household waste material interview him. Offer him a cup of tea or a glass of water and ask him if he would have the time to answer a few questions.

His name: \_\_\_\_\_ Age: \_\_\_\_\_

Number of years spent in the trade: \_\_\_\_\_

Things he carries: \_\_\_\_\_

What mode of transport does he use to roam around your colony?

- ☐ Cycle
- ☐ Motorcycle
- ☐ Four wheeler
- ☐ Cart
- ☐ Walks

Remember: He may think that answering your questions might get him into trouble – so inform him well in advance that you are doing a school project.

Ask him where he goes to sell his products. Note down the address of the shop and ask for the location.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



Ask him if he accepts products other than paper. Tick the items and verify the money offered for each.

Item	Money offered per kg	Item	Money offered per kg
<input type="checkbox"/> Metals – iron, copper, etc.,	_____	<input type="checkbox"/> Plastic	_____
<input type="checkbox"/> Cardboard	_____	<input type="checkbox"/> Bottles – plastic, metal	_____
<input type="checkbox"/> Wood	_____	<input type="checkbox"/> Electronic waste	_____
<input type="checkbox"/> Others	_____		

Thank him and try and do a similar interview with another kabadiwala. Compare your notes with your classmates and have a class discussion on the same.

Jot down – personally, did you learn anything new from your interaction with the kabadiwala?

## Gobar Gyan:

Junk dealers are a crucial link in the chain of recycling which starts with the kabadiwala. As they deal with junk at a larger scale and are often the people who send the waste to recycling units, they can teach us a lot.

Many reputed shops also offer good deals on junk. They offer four times the prices for items like newspapers and plastic than the local kabadiwala. They seem to be giving a hard time to our junk dealers.

## Activity — 2

Take a group of friends (or take the help of someone elder) and visit the shop of the junk dealer, where your kabadiwala sells his stuff. (You would already have the address if you have done the previous activity.)

What products does he deal with? (It is quite possible that he does not deal with all the items mentioned by the kabadiwala, who may be selling his collection to two or more junk dealers specialising in different kinds of waste). Also, find out where these materials go for recycling:

Item	Where it goes for Recycling (Name of the place)
Metals – iron, copper, etc.,	_____
Paper	_____
Plastic	_____
Cardboard	_____
Bottles – plastic, metal	_____
Wood	_____
Electronic waste	_____
Others	_____

Interview a few more junk dealers around and find out the major recycling centres within or outside your city. Plot all these centres on a map. Take the help of your Geography teacher. Use a camera for all the activities. Take up this entire exercise as an environmental project and using the data collected, write an article of 1,000 words on the role of kabadiwalas in waste recycling. Ask your teacher to arrange an eco-tour to one of the recycling spots in your city or nearby places.



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